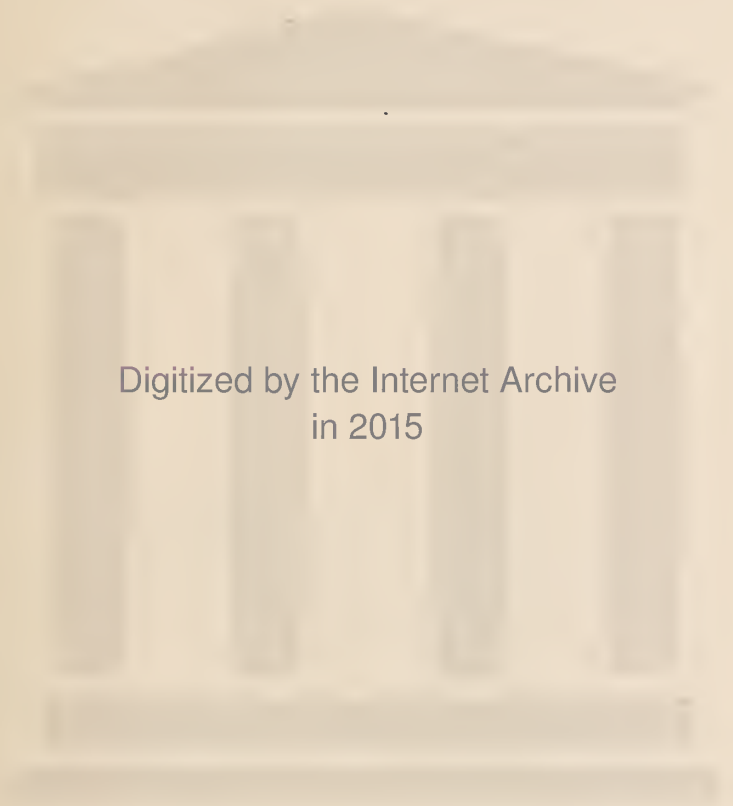

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 50.

Rust and Leopard Spot
Two Dangerous Diseases of Asparagus.

COLLEGE PARK, MD.

SEPTEMBER, 1897.

MARYLAND

Agricultural Experiment Station.

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ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

Rust and Leopard Spot
Two Dangerous Diseases of Asparagus.

By Willis G. Johnson.

A new enemy to asparagus has made its appearance in this State, which, if not taken in hand at once, may prove a very serious drawback to those engaged in the culture of this vegetable. The agent responsible for the injury is not an insect, but a fungous disease which attacks the wild as well as the cultivated asparagus. My attention was first called to it by Mr. T. Guy Woolford, of Dorchester County, who brought specimens to the Station the latter part of August. After a hasty preliminary examination, I informed Mr. Woolford that the plants were unquestionably attacked by the so-called asparagus rust, *Puccinia asparagi*, D. C., and possibly another disease belonging to the group of anthracnoses, as some stalks presented unmistakable evidence of this latter disease.

During my recent tour of inspection I have observed these diseases in the counties of Dorchester, Talbot, Caroline and Kent, on the Eastern Shore, and in Washington, Frederick, Montgomery, Prince George's, Anne Arundel and Baltimore in Western Maryland. Owing to their wide-spread distribution and their destructive nature, I have thought it advisable to issue this bulletin, calling attention, in a popular way, to the facts now known regarding them.* As we have two distinct species under consideration, we will first discuss the rust and then turn our attention to the anthracnose.

Asparagus Rust:—The rust is a comparatively new disease, having been first observed as a serious enemy to asparagus in 1896 in New Jersey, Massachusetts, Rhode Island and a few other places. Dr. Halsted, of New Jersey, Prof. Maynard and Dr. Stone, of Massachusetts, were among the first to call public attention to it. So far as is known at present its distribution is confined to the States bordering the Atlantic north of Virginia, being particularly abundant in New Jersey, Rhode Island, Long Island and Delaware. The present outbreak is the first recorded in Maryland, although it must have existed in some of our asparagus fields last year. Last season many Maryland growers noticed the premature ripening of their fields, but attributed it to the attacks of the asparagus beetles.

Asparagus Leopard Spot:—I have also observed another fungus in asparagus fields in Dorchester, Caroline and Kent Counties this season that is equally as destructive as the rust. It belongs to the group of an-

*In issuing this bulletin, I do not desire to place myself upon record as a botanist or mycologist, but wish simply to record my observations with such comments as the emergency demands.

thracnoses and is a new species. As yet it has not received a scientific name, but Dr. B. D. Halsted, of the New Jersey Experiment Station, who is working on this group, informs me under date of August 27th, that "a description has been prepared and after some further observations will be published."

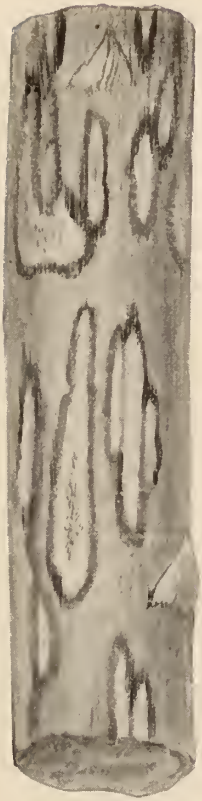
Some asparagus growers of this State have mistaken this disease for the work of the asparagus beetles. In general appearance the disease is very striking, the characteristic spots resembling the coat of a leopard, as shown in the left-hand figure of the illustration. I have therefore proposed to call it the *asparagus leopard spot* to distinguish it readily from the *asparagus rust*. By a little close observation this disease need not be confounded with injury by insects.

General Appearance:—About the middle of July, or even earlier* a plant here and there throughout the field becomes yellowish or brownish and presents a sickly appearance. This condition continues spreading until the whole field is in the same unhealthy condition. The plants then lose their fine foliage, and nothing is left but the blanched, naked stems and branches. A field of asparagus badly attacked by either the rust or the leopard spot has the general appearance of having had every stalk girdled, which afterwards withered and died, leaving only the seared, blighted, rusty-looking stems and branches.

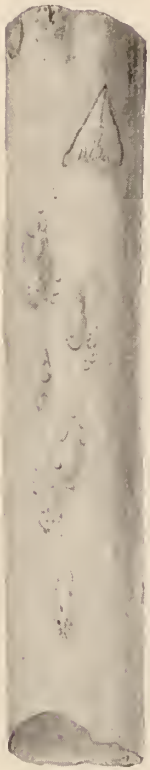
The diseases first attack the terminal growth of the plants, and then gradually work their way down the stems and main stalks until they are killed. Shortly after the rust has started, the leaves and stems become blistered and studded with blackish masses of spores of various sizes, which stand out very conspicuously. (See illustration.) Sometimes the blisters are covered with other small blackish dots, as shown in the right-hand figure of the illustration. These are due to still another fungus (*Darluca filum*, Cast.) which is parasitic upon the rust; or to express it more plainly, it is a parasite upon a parasite. There is some hope that it may prove helpful to the asparagus growers of this State, as it has been found abundant in a large field in Kent County.

Nature of the Diseases:—These diseases are very small plants themselves, which send their microscopic rootlets into the tissues of the asparagus plant, robbing it of its vitality by absorbing the plant foods and breaking down its cellular structure. They then break through the epidermis, and myriads of spores, corresponding to seeds of higher plants, are produced. They become detached and fall to the ground, where they remain over winter, and find their way back to the young plants the following season to begin their work of destruction. The yield from fields infested with these diseases has been greatly reduced, one grower having reported this season that his crop was short fully one-half.

*Dr. Halsted has found it "as early as the middle of May upon volunteer plants along roadsides."



LEOPARD SPOT.



RUST.

DISEASES OF ASPARAGUS (Original).

How the Diseases are Spread:—It is strange that diseases of such a ravenous nature should appear almost simultaneously over large areas and in fields that have been in asparagus continously for the past forty years or longer. I have this season seen asparagus beds varying in size from a small garden patch to ten acres prematurely killed by these fungous enemies.

It seems quite possible that the asparagus beetles are important factors in the distribution of these plant parasites. I have observed in several instances this season that the rust was especially bad in sections where the beetles and their larvae had seriously injured the asparagus; while on the other hand I have seen fields badly rusted where very few beetles were observed. Nevertheless, I believe that the beetle not only carries the germs of the disease, but that the spores find most favorable conditions for lodgment and germination on plants that have been injured by them. I have seen both diseases in their earliest stages of development in wounds on asparagus made by the asparagus beetles and grasshoppers. The asparagus beetle is also preyed upon by several species of wasps and other predaceous insects, the most common of which is the so-called stink bug, a family of hemipterous insects. No doubt these insects cary the spores of the diseases from place to place as they capture and destroy the larvae of the asparagus beetles.

It seems plausible also that the diseases are distributed by the sale of roots taken from infested beds. Late in the fall, after the spores have matured and fallen to the ground, the chances are that many of them are attached to the roots when dug, carried long distances, and infest new fields. Wind and water must also carry spores long distances.

Remedial Measures :—It must be acknowledged that these ravenous and destructive pests have come as suddenly upon asparagus growers and scientists as came the Goths and Huns who "ploughed Rome and harrowed Italy." Watchfulness has been no protection to the fields of the careful asparagus grower. Beds varying in age from one to forty years have met one common fate, and their bare and blasted stalks everywhere tell the same tale.

The diseases under discussion belong to groups of fungi which are very difficult to combat; and from what experience has taught us, the rust and leopard spot of the asparagus are no exceptions to the rule. Various methods have been suggested for their control, and some of them have been tried; but there is a difference of opinion as to their practical value. Cutting and burning over infested fields in midsummer has been resorted to; but it is questionable whether or not such treatment, continued for several years, would not be as harmful to the vitality and longevity of the plants as the diseases themselves. At present we cannot see much help, so far as prevention in concerned, from the use of fungicides, especially when used as sprays in large fields. Neither is there any chance for a rotation of crops, as asparagus is perennial. What, then, can be done? This is a question that the experimentor must yet solve.

So far as observation goes, the character of the soil has no direct

influence upon the asparagus diseases. Fields that have been highly fertilized with kainit, nitrate of soda or stable manure, show no greater immunity from attacks than those where nothing was applied. So far as varieties are concerned, it does appear as if some are less subject to the attacks of the diseases than others. Prof. L. F. Kinney, of the Rhode Island Experiment Station, has observed that Palmetto plants were not so severely injured as the Conover's colossal or Moore's hybrid, even where they were growing in the same rows.

Anyone reviewing these facts cannot help admitting that we have to combat two very virulent diseases, and that it is of the utmost importance that a remedy for their control and suppression should be speedily found. While there is still a doubt about the practical utility of mowing and burning over infested fields, this remedy is recommended until a more efficient one is discovered.

The Experiment Station is very anxious to obtain all the information possible about these diseases, and any notes of observations sent will be greatly appreciated. We would like to know the comparative yield of infested and uninfested fields, or any points about varieties, distribution, fertilization and cultivation.

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 51.

HORSE FEEDING.

Tests of the Digestibility of Oats, Corn, Hay and the New Corn Product.

COLLEGE PARK, MD.

DECEMBER, 1897.

MARYLAND

Agricultural Experiment Station.

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COLLEGE PARK, MD.

HORSE FEEDING.

TESTS OF THE DIGESTIBILITY OF WHOLE AND GROUND OATS, SHELLED CORN AND CORN MEAL, TIMOTHY HAY AND THE NEW CORN PRODUCT: ALSO A TRIAL OF SOME RATIONS, USING THE NEW CORN PRODUCT AS A SUBSTITUTE FOR HAY.

By H. J. Patterson, B. S., Chemist.

Considering the important place which horses occupy among domestic animals, it is surprising that so little time, comparatively, has been given to a study of the character of food and manner of feeding best adapted to their needs under different conditions and according to the various demands made upon them.

There is more knowledge demanded upon the subject of feeding horses, not only because of their position, but also because of the great importance of knowing how to maintain them most economically. In horse feeding, as in many other things, it is necessary to keep pace with changing conditions and not practice the wasteful methods prevalent in times past, especially such waste as is commonly found among farmers. Again one sees the necessity for more knowledge along this line when proper consideration is given to the well recognized fact among veterinarians that improper feeding is responsible for most of the digestive disorders met with.

CONDITION IN HORSE FEEDING.

The state of perfection to which the higher class of horses has been brought in this country is attributed not only to the great attention devoted to the selection of the best types for the purpose of perpetuating the species, but also to the nature of the food with which they have been supplied and the treatment they have received, under the influence of a propitious climate.

Practical experience has assured us that the climate and atmosphere of this country are suitable to the constitutions of the equine tribe; but that the varying nature and at times great severity of the elements makes protection necessary in order to avoid their deleterious effects. For the best results, whether the horse be for ordinary farm

work, for the cart, for the carriage, or for the race track, it is all important that their quarters should be warm, well ventilated, and supplied with pure and uncontaminated air. After furnishing these conditions the next great necessity is to carefully observe the food requirements and supply them.

OBJECTS IN HORSE FEEDING.

The objects sought in horse feeding are rather different from those desired in feeding any other class of domestic animals, and in consequence the points to be observed are, in a measure, peculiar. From the birth of a horse until arrival at an age for actual service the aim is to develop to the greatest degree the endurance and physical powers of the animal. These qualities depend upon the muscular fiber, sinews and bone, and they in turn are dependent upon the quality and quantity of food. After having grown and developed a horse with the desired qualities, the next consideration is to feed the animal in such a way that all the bodily functions may be supported, bodily wastes replaced, and the whole be maintained in its normal condition. If the animal is subjected to comparative rest there will be one kind of food required; if subjected to heavy work such as hauling loads slowly, there will be a food required to supply the energy as needed; or, so to speak, a food (fuel) of slow combustion; if the work is of a character that requires rapid action such as the trotting horse is subjected to, there will be demanded a food of a very different character from either of the former; or, so to speak, it will require a food (fuel), of rapid combustion.

In all horse feeding the aim is to maintain the force and endurance which the horse already possesses, and to develop these qualities when possible. When it is desired to have a horse increase in weight and size and take on a well-rounded appearance, it should be done by adding to his muscle rather than to increase greatly the amount of adipose substances. This kind of development can only be done comparatively slowly and when the animal is subject to such work as will develop muscle and keep down fat.

It is only the superficial judges of horses that are satisfied and pleased with the bones being covered, the points filled out, and general contour well-rounded; the person well versed in horses easily distinguishes between the appearance of a fat and of a muscular animal.

HORSE FOODS.

Every description of food contains nutritive properties, and abounds in a greater or less degree with the elements calculated for the construction of the different substances of which the animal body is composed. It is therefore important in selecting food for any class of animals, and for horses in particular, that those are obtained which contain the most of those compounds which are convertible into substances

which render the animal of the highest value. The animal's growth and development of muscle, bone and sinew depend greatly upon the kind of food with which they have been supplied.

The subject of Horse Feeding can be conveniently divided into three parts: 1st, Water; 2nd, Grain Foods; 3rd, Long Foods, (hays or fodder).

Water:—Water for horses, as indeed water for all classes of domestic animals, should be free from organic matter or any contamination whatever. In fact it should be of just as good quality and as pure as required for man, and on no account should the idea be entertained that any water that stock can be persuaded to drink is of sufficient purity.

Horses should receive all the water they will drink, but in giving it to them due regard should be given to the condition of the animal at time of watering. Horses at rest should be watered three times a day, and when working should have small quantities frequently rather than allowed to drink much at one time. For the best results a horse should never be watered immediately before or after feeding.

Grain Foods:—Oats and corn are the principal grains used in horse feeding, and are generally recognized as the best ones; but rye, barley and wheat are considerably used, and the by-products, wheat, bran, linseed meal and gluten meal are used extensively as supplemental to the other grain rations.

Long or Bulky Food:—Timothy hay is almost universally considered as the best of the long foods for horses, yet many hays from mixed grasses are used, and is some sections alfalfa hay. In recent years in some sections cut and shredded corn fodder has become very popular, and for many years corn blades have been preferred, in the South, by the keepers of race horses.

Roots:—In some sections beets, carrots and potatoes are fed to horses in limited quantities for the purpose of improving the appetite and for the general beneficial action upon the digestive system. For this purpose they can be recommended, but they should never be fed in large quantities.

EXPERIMENTS CONDUCTED WITH HORSES.

The tests made in horse feeding, which form the basis for this bulletin, are as follows:

I. The determination of the digestibility of timothy hay by horses.

II. The determination of the digestibility of whole oats by horses.

III. The determination of the digestibility of ground oats by horses.

IV. The determination of the digestibility of shelled corn by horses.

V. The determination of the digestibility of corn meal by horses.

VI. The determination of the digestibility of the new corn product by horses.

VII. Tests of the use of the new corn product as a substitute for hay in horse feeding.

These experiments were undertaken with the object of acquiring some data of a more definite character than has been possessed before with reference to the comparative value of whole and ground grains, and also to determine whether the digestion coefficients of American feeding stuffs, which have been obtained in the most part with ruminants, are applicable to horses. Again, some phases of this question which are being discussed made it of interest to determine materials and the values of the same for use in horse feeding as a substitute for hay.

Horses are generally more unlike in their powers of digestion or in the uses they make of their food than a herd of cattle or a flock of sheep, largely due, no doubt, to the fact of the irregular and varying degrees of work to which horses are subjected. Then again, horses are generally worked to the full extent of their powers and at all ages so that individual weaknesses and feebleness in old age make themselves manifest. Consequently many difficulties are in the way of arriving at exact knowledge and fixed data which can be used as a universal guide.

METHODS AND APPARATUS USED.

The lengths of the periods in most cases were fourteen days, but in a few instances the tests were conducted for a longer time. The first nine days of each period were used as a preliminary period to allow any effects of previous feed to be overcome, and the digestion period covered five days.

During the digestion period the dung and urine were collected and samples drawn from each for analysis. The samples were drawn daily and dried to the air dry state. The sizes of the samples were in proportion to the total amount of excreta. Composite samples were made for each horse for each period.

The apparatus used in these tests was the same as used in the digestion experiments with steers, which is described and illustrated on page 167 of Bulletin No. 43, with a few modifications to adapt the trough and harness to the horses.

ANIMALS USED.

The animals used in the digestion experiments were two horses which were specially purchased for this work. They were of medium size, and while having some defects, yet had a good and normal digestion system. Horse No. 1, was four years old, weighed about 850 pounds and was sound with the exception of being blind in one eye. Horse No. 2, was nine years old, weighed about 950 pounds and had a defect in his wind which is known as a "Blower" or "Roarer."

FEEDS USED.

Oats:—The oats used were purchased in Baltimore, and were No. 1 white oats in quality. The ground oats used were from the same lot, and had been ground at the local mill.

Corn:—The corn used was raised on the Station Farm, and was of the Yellow Dent variety. The meal was from the same kind of shelled corn, and was ground by the local mill.

Hay:—The timothy hay used was raised on the Station farm. It was cut when in full bloom, nicely cured, and such hay as would generally pass as No. 1.

The New Corn Product:—The new corn product used is the same meterial as described on page 165 of Bulletin 43, and was made from fodder grown in the neighborhood of the Rockford Illinois factory.

The other feeds used in the feeding tests were hominy chop, linseed meal and King gluten meal, which were bought in the general markets and were of good quality and about average composition.

The composition of the feeds used are given in Table I, that of the dungs in Table II, and the nitrogen contents of the urine in Table III, which are as follows:

Table I.—Composition of Foods Used in Horse Feeding Experiments.

Index No.	Description of Sample.	Water	Ash.	Protein.	Crude fiber	N free extract	Fat.
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
1992	Timothy hay.....	11.41	4 57	4.45	33.20	42.99	3.38
2114	New corn product ..	8.51	5.41	6 56	27.30	49.30	2.92
1994	Oats—1st lot.... ..	8.56	3.68	12.42	11.91	56 53	6.90
2090	Oats—2d lot.....	9.26	3.45	13.82	9.85	57 36	6.96
2000	Shelled corn.....	22.22	1 33	8.53	1 72	62.27	3.93
2112	Corn meal.....	12 69	1.85	9.28	1.71	70.07	4.40
2049	Ground oats.....	8.59	3.61	13.21	8.81	59.38	6 40
1996	Ground rye.....	10.09	1.98	11.76	2.49	65.17	2.51
1999	Hominy chop.....	17.63	2 69	9.57	4.43	55.38	10.30
1997	Linseed meal.....	10.00	4.38	37.36	8.98	31 70	7.60
1998	Gluten meal.....	11.41	1.68	34.16	1 76	35.19	15.80
2001	Wheat bran	17.51	5.24	14.63	10.92	46.28	5.42
2121	Complete ration....	10.93	4.32	12.91	16.75	49.89	5.20

Table II.—Composition of Dungs from Horses on Digestion Experiments.

Index No.	Description of Sample.	Water.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
		Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
2031	Horse 1—Feed timothy hay only	76.08	1.44	1.75	8.87	11.00	0.86
2037	Horse 2—Feed timothy hay only	80.46	1.18	1.32	7.61	8.74	0.69
2023	Horse 2—Feed oats only	62.41	3 52	2.34	11.42	18.47	1.84
2007	Horse 1—Feed timothy hay and oats	71.39	2.71	2.07	9.35	12.97	1.51
2017	Horse 2—Feed timothy hay and oats	75.90	1.69	1.61	8.88	11.07	0.85
2046	Horse 1—Feed timothy hay and ground oats	72.74	2.20	2.20	9.99	11.74	1.13
2054	Horse 2—Feed timothy hay and ground oats	76.92	1.57	1.82	8 67	10.07	0.95
2060	Horse 1—Feed timothy hay and shelled corn	71.73	1.65	2 43	10.77	11.84	1.58
2074	Horse 2—Feed timothy hay and shelled corn	75.66	1.37	2.79	8.19	10.67	1.32
2081	Horse 1—Feed timothy hay and corn meal	72.35	2.28	2.52	9.31	12.18	1.36
2087	Horse 2—Feed timothy hay and corn meal	80.12	1.32	2.10	7.26	8.18	1 02
2093	Horse 1—Feed N. C. Product and ground oats	75.30	2.05	1.76	6.67	12.47	1.15
2099	Horse 2—Feed N. C. Product and ground oats	79.16	1.95	1.26	6.51	10.55	0.57
2105	Horse 1 — Feed Complete Ration—N. C. P. base.	73.73	2 98	2.11	8.38	11.68	1.12
2111	Horse 2 — Feed Complete Ration—N. C. P. base.	80.58	1.84	1.51	6.27	9.09	0.71

Table III.—Percentage of Nitrogen in Urine.

Index No.	Horse No.	Ration.	Nitrogen Per Cent.
2012	1	Whole oats and timothy hay	1.50
2018	2	" " " " "	1.53
2024	2	Oats only	2.01
2032	1	Timothy hay only	.77
2038	2	" " "	.78
2047	1	Ground oats and timothy hay	1.34
2055	2	" " " " "	1.33
2061	1	Shelled corn and timothy hay	.88
2069	2	" " " " "	1.15
2082	1	Corn meal and timothy hay	1.22
2088	2	" " " " "	1.39
2 94	1	Ground oats and new corn product	1.24
2100	2	" " " " " "	1.64
2106	1	Mixed ration N. C. P. base.	1.85
2112	2	" " " "	1.94

I.—DETERMINATION OF THE DIGESTIBILITY OF TIMOTHY HAY.

Timothy hay is the standard coarse fodder, or long food, of the horse in most parts of the United States, and as a rule, where it can be had of good quality, in abundance and cheaply, there is little else to be

desired in the way of hays for horses. The digestive coefficients of foods for the horse have in the most part been determined by German experiments conducted upon the kinds and qualities found in that country. The most prominent digestion experiments with the horse were those which were performed by Wolff, at Hohenheim, and the feeds used were chiefly oats and meadow hay. The results of these tests showed that horses did not possess as great digestive powers as ruminants, and in the case of hay the difference amounted to 11 or 12 per cent. of the dry substance. Nearly, if not all, the tests of the digestibility of timothy hay that are recorded have been made with ruminants; it, therefore, seemed desirable to obtain the coefficients with horses in order to determine the relative difference and have this data, which is so important a factor in the calculation of rations for horses.

During the digestion experiment with timothy hay the horses received nothing but hay and water, no grain whatever being allowed. The animals were fed regularly and given all they would eat. The amounts consumed were much less than expected, but the horses seemed satisfied, and ate the amounts indicated with a relish. The nutriment furnished by the quantity of hay was evidently sufficient for their wants as is evidenced by the weights. The weights in this and in all cases recorded in this bulletin were the average of two weighings. The weights were taken on Saturdays and Mondays, and the average considered to be the weight on the Sunday intervening.

The following table gives all the data with reference to the length of periods, quantity of food and water consumed and excreted, &c:

Table IV.—Ration, Timothy Hay Only.

		Horse No 1.	Horse No. 2.
Length of preliminary period		11 days.	11 days.
Length of digestion period		7 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Timothy hay	54,660	55,560
	Water drunk	152 640	185,460
Food consumed in digestion period.	Timothy hay	36,000	30,000
	Water drunk	92,040	94.480
Excrement	Dung	69,640	82,580
	Urine	33,320	21.260
Weight of horses	At beginning of experiment.	857 lbs.	944 lbs.
	At end of experiment	857 "	946 "

Taking the data given in the above table and the composition of the food and exereta, the digestion coefficients indicated in Table V are obtained.

Table V.—Digestibility of the Components of Timothy by Horses.

Length of Digestion period: Horse No. 1—7 Days; Horse No. 2—5 Days.

(In Grams, 453.6 Grams = 1 Pound.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay eaten (1992*)	36,000	31.895	1,645	1,602	11,955	15,476	1,217
Dung excreted (2031*)...	69,640	16,657	1,003	1.218	6,177	7,660	599
Digested.....	.....	15,238	642	384	5,778	7.816	618
Per cent. digested	.....	47 77	39.03	23.97	48.34	50.51	50.78
Horse 2.							
Hay eaten (1992*).	30.000	26,577	1,371	1,335	9,960	12 897	1,014
Dung excreted (2037*)...	82,580	16,136	974	1,090	6,284	7,218	570
Digested.		10,441	397	245	3,676	5.679	444
Per cent. digested.....	.....	39.30	28.96	18.35	36.90	44.05	43.79
Average for 2 horses....	.....	43.54	33.99	21.16	42.62	47.27	47.28
Pounds digestible in 100 lbs. of hay.	.....	38 5	1.5	0.9	14.2	20.3	1.6

*These figures refer to index numbers in Tables I and H.

Giving a nutritive ratio of 1:42.3 for timothy hay.

Bringing the above results together with the average obtained with ruminants, we have the following:

Table VI.—Digestibility of Timothy Hay (Per cents.)

	Dry substance.	Ash.	Protein.	Crude fiber.	N-Free extract.	Ash.
By horses (average of 2 trials.....	43.54	33.99	21.16	42 62	47.27	47.28
By ruminants (22 trials)... Minimum.	47.0	... .	38.8	37.2	55.6	34.6
By ruminants (22 trials)... Maximum.	65.7	.....	60.4	62.1	71.8	61.8
By ruminants (22 trials)... Average..	53.0	.....	45.0	46.0	60.0	54.0

Using the above coefficients and the compositions of the hay used in this test and that of the average hay, and making the respective calculations, we obtain the amounts of available food constituents as shown in Table VII.

Table VII.—Quantity Digestible in 100 Pounds of Timothy Hay.

		Dry Substance.	Ash.	Protein.	Crude Fiber.	N-free Extract.	Fat.	Nutrition Ratio.
By horses.	Hay used in this experiment..	38.5	1.5	0.9	14.2	20.8	1.6	1:42.3
	Average Hay..	37.8	1.5	1.3	12.4	21.3	1.3	1:28.1
By Ruminants	Hay used in this experiment..	46.9	1.0	2.0	15.2	25.8	1.9	1:22.7
	Average hay..	46.1	...	2.6	13.2	27.0	1.3	1:16.6

These figures agree quite closely with those obtained in the Hohenheim tests as to the relative amounts of total dry substance digestible by horses and ruminants, but the differences in the quantities of digestible protein is considerably greater. This causes a wide range in the nutritive ratios.

It will be noticed that the coefficients of digestibility for the protein obtained in this test is relatively low, which may be attributed to the small quantity of food eaten and in consequence a relatively greater amount of metabolic nitrogenous elements in the excreta; though the weights of the animals would seem to indicate that there was a considerable loss in this way. Also careful examination could detect nothing of this nature.

Nitrogen determinations were made in the urine, which, on calculation, give the following figures, and show that though the weights of the animals seemed to indicate a state of equilibrium, the real condition was far from such:

	Quantity of Urine. Grams.	Per cent. Nitrogen.	Quantity of Nitrogen in Urine. Grams.	Quantity of Nitrogen Assimilated. Grams.	Difference. Grams.
Horse 1.....	33,320	0.77	256.6	61.4	Loss..195.2
Horse 2	21,260	0.78	165.8	39.2	Loss..126.6

These figures would seem to prove that timothy hay was entirely inadequate for the maintenance of horses even at comparative rest, unless they could be persuaded to eat three or four times as much as was consumed in this test.

Should the weights of the horses be assumed to represent the truth, then there must have been a state of equilibrium between the nitrogen assimilated and the nitrogen excreted in the urine. Making calculations upon this assumption, we find that all the nitrogen fed would have been digested, which would evidently not represent the truth. The probable correctness of the coefficients as given in Table V, will become apparent on comparison with the figures given in Table XII, Page 23, when the manner in which they were obtained is considered.

II.—THE DIGESTIBILITY OF WHOLE OATS.

In making the determination of the digestibility of oats it was expected that the animals could be kept on a diet of the grain alone for a sufficient length of time for obtaining the necessary data; but this was found impracticable. At first the horses would eat a normal amount and seem to require nothing further, but before the evidence of hay had disappeared from the dung there would be a very manifest dissatisfaction with the ration, as shown first by eating at the stalls, then a loss of appetite and dislike for the grain and drinking very little water.

A summary of this attempt at confining the horses on a ration of nothing but grain is given in Table VIII.

Table VIII.—Ration, Oats Only.

		Horse No. 1.	Horse No. 2.
Length of preliminary period		4 days.	8 days.
Length of digestion period		0 days.	3 days.
		Grams.	Grams.
Food consumed in preliminary period.	Grain		47.340
	Water drunk		88,670
Food consumed in digestion period.	Grain		1,660
	Water drunk		10,140
Excrement	Dung		5.060
	Urine		10.390
Weights of horses	At beginning of experiment		972 lbs.
	At end of experiment		944 "

Horse No. 1 commenced by eating 6000 grams per day, and by the end of the fourth day would not eat any, and would drink very little.

Horse No. 2 consumed 6750 grams per day, and commenced to eat less by the seventh day and gradually less until he would eat none by the tenth day.

The change of weight of course is probably largely due to the difference in the stomach contents. The results recorded agree clearly with those so frequently experieneed in the Army when on expeditions into sections where it is impossible to get hay or carry it with them.

To test if the dung exereted was any index as to what was taking plaee, samples were taken and analyzed, but the results, on caleulation as to the amount eonsumed during the time, showed no relation whatever between consumption and excretion, and were extremely negative.

In eonsequence of the above results we were forced to introduce hay into the ration, and to assume it to have the same digestitbility when fed in the eombination as when fed alone, so that the coefficients for the timothy hay could be used as a constant factor. This assumption is not strictly correct—at least with certain food conponents, as will appear in subsequent discussions. The timothy hay used in this portion of the work, and in all other tests in this bulletin, was the same as used when hay was fed alone.

It was the aim and desire to have the horses eat the same quantity of hay at all times, but their appetites did not demand it, and the quantities had to be varied accordingly.

In feeding, the grain was divided into three feeds, (morning, noon and night) and the hay given only at the morning and night feeds. The hay was cut so as to be two or three inches long in order to facilitate feeding and prevent loss.

The details of consumption, excretions, weights, &c., are as follows:

Table IX.—Ration, Timothy Hay and Whole Oats.

		Horse No. 1.	Horse No. 2
Length of preliminary period		8 days.	14 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Timothy hay	20,176	54,790
	Grain	48,000	84,000
	Water drunk	108,350	306,020
Food consumed in digestion period.	Timothy hay	10,930	16,390
	Grain	30,000	30,000
	Water drunk	61,520	91,980
Excrement	Dung	39,500	73,570
	Urine	22,630	24,480
Weight of horses	At beginning of experiment.	852 lbs.	973 lbs
	At end of experiment	860 "	972 "

From this data and the composition of the feeds and dungs and making deductions for the hay, we obtain Table X.

Table X.—Digestibility of Whole Oats by Horses.

Rations Fed—Timothy Hay and Whole Oats. (Length of Digestion Period—5 Days.

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Gram	Grams	Grams	Grams	Grams	Grams
Hay eaten (1992)	10,930	9,682	499	486	3,629	4,699	369
Grain eaten (1994)	30,000	27,432	1,104	3,726	3,573	16,959	2,070
Total eaten	40,930	37,114	1,603	4,212	7,202	21,658	2,439
Dung excreted (2007)	39,500	11,304	1,070	818	3,696	5,124	596
Total digested		25,810	533	3,394	3,506	16,534	1,843
Digested from hay		4,625	195	116	1,755	2,373	187
Digested from grain		21,185	338	3,278	1,751	14,161	1,650
Per cent. digested from grain		77.24	30.61	87.98	49.01	83.52	80.00
Horse 2.							
Hay eaten (1992)	16,390	14,520	729	729	5 442	7,046	554
Grain eaten (1994)	30,000	27,432	1,104	3,726	3,573	16,959	2,070
Total eaten	46,390	41,952	1,853	4,455	9,015	24,005	2,624
Dung excreted (2017)	73,570	17,728	1,243	1,184	6,532	8,144	625
Total digested		24,224	610	3,271	2,483	15 861	1,999
Digested from hay		5,707	217	133	2,009	3 104	243
Digested from grain		18,517	393	3,138	474	12,757	1,756
Per cent. digested from grain		67.51	35.60	84.22	13.26	75.23	84.83
Average for two horses		72.38	33.10	86.10	31.14	79.38	82.42
Pounds digestible in 100 lbs. of oats		66.2	1.2	10.7	3.9	44.8	5.6

Giving a nutritive ratio of 1:5.73 for whole oats.

The nitrogen excretion and consumption is shown by the following figures (Table XI). It will be seen that there was considerably more nitrogen assimilated than excreted, and on examining the weights we see that they remain practically constant, from which it may be concluded that the food consumed was sufficient to support all bodily functions.

Table XI.—Showing Distribution of Nitrogen During Digestion Test.

	Quantity of Urine Excreted.	Per cent. Nitrogen.	Quantity of Nitrogen Excreted.	Quantity of Nitrogen Assimilated.	Difference.
Horse No. 1.....	22,630	1.50	353 8	543.0	Gain..190 8
Horse No. 2.....	24,480	1.53	374.5	523.4	Gain 148.9

Bringing the coefficients obtained above into one place with those obtained for oats by Wolff in the Hohenheim experiments, we have the following:

Table XII.—Per Cents. Digestible.

	Dry substance.	Protein.	Crude fiber.	N-free extract.	Fat.
Oats—this experiment..	72.4	86.1	31.1	79.4	82.4
Oats—Wolff.....	....	87.0	26.0	77.0	78.0

The results of these two experiments show a remarkable agreement, and would give strong indication (considering the fact that the hay coefficients were used as a constant and deducted in determining those of oats) that the digestion coefficients for hay were nearly correct.

III.—THE DIGESTIBILITY OF GROUND OATS BY HORSES.

There is considerable diversity of opinion as to the relative value of whole, bruised, crushed and ground oats for horses, and as to their digestibility by horses of different ages. To get some data on these points it was decided to make the test with ground oats rather than any of the intermediate stages. Spooner gives as his opinion that horses do not eat bruised and crushed oats with an appetite, and that oats in this condition are apt to cause diarrhoea in horses which are worked hard. Experiments with whole and ground grain for work horses at the Utah Station showed no advantage of one over the other.

The oats used were of the same quality as fed whole, but had been ground.

The horses were fed, at first, the same relative quantities of hay and grain as used in the periods when on hay and whole oats, but it was soon found that they would not eat nearly as much grain and would take more hay, consequently it was deemed better to feed all of each kind of food that would be consumed rather than limit the quantity of hay and introduce the error which might be caused by a dissatisfied appetite.

The following are the details of the feeding, &c.:

Table XIII.—Rations, Timothy Hay and Ground Oats.

		Horse No. 1.	Horse No. 2
Length of preliminary period		9 days.	9 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Timothy hay	31,510	36,000
	Grain	28,070	37,500
	Water drunk	99,800	146,970
Food consumed in digestion period.	Timothy hay	20,000	20,000
	Grain	14,800	15,500
	Water drunk	71,220	82,220
Excrement	Dung	47,280	59,660
	Urine	15,880	19,420
Weights of horses	At beginning of experiment.	856 lbs.	946 lbs
	At end of experiment	856 "	951 "

Making similar calculations and deductions for the hay as in obtaining the coefficients for whole oats, we have the figures in Table XIV for ground oats.

Table XIV.—Digestibility of Ground Oats by Horses.

Rations Fed—Timothy Hay and Ground Oats. (Length of Digestion Period—5 Days.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay eaten (1992).....	20,000	17,781	914	890	6,640	8,598	676
Grain eaten (2040).....	14,800	13,528	534	1,955	1,304	8,788	947
Total eaten.....	34,800	31,246	1,448	2 845	7,944	17,386	1,623
Dung Excreted (2046)....	47,280	12,890	1,040	940	4,726	5,550	534
Total digested..	... ...	18,356	408	1,805	3,218	11,836	1,089
Digested from hay	.....	8,495	357	213	3,210	4,345	343
Digested from grain....	.....	9,861	51	1,592	8	7,491	746
Per cent. digested from grain	.....	72.91	9.55	81.44	0.61	85.23	78.77
Horse 2.							
Hay eaten (1902).....	20,000	1.7781	914	890	6,640	8,598	676
Grain eaten (2049).....	15,500	14,170	561	2,047	1,366	9,204	992
Total eaten..... ...	35,500	31,888	1,475	2,937	8,006	17,802	1,668
Dung excreted (2054)....	59,660	13 770	936	1,086	5,172	6,009	567
Total digested	.....	18,118	539	1,871	2,834	11,793	1,101
Digested from hay	.....	6,988	265	163	2,450	3,785	297
Digested from grain.....	.....	11,130	274	1,708	384	8,008	804
Per cent. digested from grain.....	.....	78.55	48.85	83.44	28.11	87.00	81.04
Average for 2 horses		75.73	29.20	82.44	14.36	86.12	79.90
Pounds digestible in 100 lbs. of ground oats....	.....	69 3	1.0	10.9	1.2	51.1	5.1

Giving a nutritive ratio of 1:5.84 for ground oats.

Bringing the results for whole and ground oats together for comparison, we have the following:

Table XV.—Digestion Coefficients and Quantities Digestible in 100 Pounds of Whole and Ground Oats.

	Dry substance.	Ash.	Protein.	Crude Fiber.	N-free extract.	Fat.	Nutritive ratio.
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Whole oats.....	72.4	33.1	86.1	31.1	79.4	82.4	.....
Ground oats	75.7	29.2	82.4	14.4	86.1	79.9	.....
Quantity available in 100 pounds of:	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Whole oats.....	66.2	1.2	10.7	3 9	44.8	3.6	1:5.73
Ground oats.....	69.3	1.0	10.9	1.2	51.1	5.1	1:5.84

The average results are slightly in favor of the ground oats. An examination of the results with the young horse (No. 1) and the old horse (No. 2,) shows that the whole oats were more digestible by the young horse and the ground oats by the old horse. From this we would conclude that, other things being equal as to appetite, ability to perform work, &c., with a lot of horses of varying ages, the most can be obtained from oats by feeding it ground.

IV.—A COMPARISON OF THE DIGESTIBILITY OF SHELLED CORN AND CORN MEAL (GRAIN OR MAIZE).

In this portion of the work the same kind of timothy hay was fed in conjunction with the grain as was used in the tests already described, and hence the same constant factor introduced.

It was recognized in planning these experiments that whole corn was, as a rule, fed on the cob rather than shelled; but from the fact that many horses will at times eat a portion of the cob, it was deemed best to have the corn shelled, and so eliminate the error which would be introduced by the consumption of a variable quantity of cob. As already described, the corn meal was from the same kind of corn as that fed whole.

In these tests, as in those with oats, it was not possible to have the same relative consumption of grain and hay at all times, yet the agreement is much closer than in the oats periods.

The details of the feeding periods are given by the following tables XVI and XVII:

Table XVI.—Ration, Timothy Hay and Shelled Corn.

		Horse No. 1.	Horse No. 2.
Length of preliminary period		9 days.	9 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Timothy hay	32,010	31,120
	Grain	20,750	31,500
	Water drunk	86,300	125,320
Food consumed in digestion period	Timothy hay	15,000	15,000
	Grain	15,000	15,000
	Water drunk	40,350	57,640
Excrement	Dung	33,560	47,130
	Urine	15,050	9,890
Weight of horses	At beginning of experiment.	856 lbs.	951 lbs.
	At end of experiment	842 "	957 "

Table XVII.—Ration, Timothy Hay and Corn Meal.

		Horse No. 1.	Horse No. 2.
Length of preliminary period		9 days.	9 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Timothy hay	27,000	27,000
	Grain	24,120	35,000
	Water drunk	85,150	109,910
Food consumed in digestive period.	Timothy hay	15,000	15,000
	Grain	14,350	17,500
	Water drunk	43,640	66,590
Excrement	Dung	32,140	46,090
	Urine	6,780	13,910
Weight of horses	At beginning of experiment.	842 lbs.	935 lbs.
	At end of experiment	832 "	935 "

From these, with the data furnished by Tables I and II, we calculate the result as given in Tables XVIII and XIX.

Table XVIII.—Digestibility of Shelled Corn by Horses.

Rations Fed—Timothy Hay and Shelled Corn. (Length of Digestion Period—5 Days.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay eaten (1992)	15 000	13,287	685	667	4,980	6,448	507
Grain eaten (2000)	15,000	11,667	200	1,279	258	9,340	590
Total eaten	30,000	24,954	885	1,946	5,238	15,788	1,097
Dung excreted (2060)	33,560	9,490	554	816	3,614	3,976	530
Total digested	.....	15,464	331	1,130	1,624	11,812	567
Digested from hay	.....	6,354	267	160	2,407	3,258	257
Digested from grain	.....	9,110	64	970	.....	8,554	310
Per cent. digested from grain	.....	78.08	32.00	75.84	.....	91.57	52.54
Horse 2.							
Hay eaten (1992)	15,000	13,287	685	667	4,980	6,448	507
Grain eaten (2000)	15,000	11,667	200	1,279	258	9,340	590
Total eaten	30,000	24,954	885	1,946	5,238	15,788	1,097
Dung excreted (2074)	47,130	11,471	646	1,315	3,860	5,028	622
Total digested	.....	13,483	239	631	1,378	10,760	475
Digested from hay	.....	5 222	198	122	1,837	2,838	222
Digested from grain	.....	8,261	41	509	.....	7,922	253
Per cent. digested from grain	.....	70.81	20.50	39.80	.....	84.82	42.88
Average for 2 horses	.....	74 44	26.25	57.82	.....	88.19	47.71
Pounds digestible in 100 lbs. of shelled corn	.....	57.9	0.3	4 9	(-4.9)	54.9	1.9

Giving a nutritive ratio of 1:10.6.

Table XIX.—Digestibility of Corn Meal by Horses.

Rations Fed—Timothy Hay and Corn Meal. (Length of Digestion Period—5 Days.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Hay eaten (1992)	15,000	13,287	685	667	4,980	6,448	507
Grain eaten (2113)	14,350	12,529	265	1,332	245	10,056	631
Total eaten	29,350	25,816	950	1 999	5,225	16 504	1,138
Dung excreted (2081)	32,190	8,900	734	811	2,997	3 920	433
Total digested		16 916	216	1,188	2,228	12,584	700
Digested from hay		6 354	267	160	2,407	3,258	257
Digested from grain		10,562		1,028		9,326	443
Per cent. digested from grain		83.96		77.18		92.74	70.21
Horse 2.							
Hay eaten (1992)	15,000	13 287	685	667	4,980	6,448	507
Grain eaten (2113)	17,500	15,280	324	1,624	299	12,263	770
Total eaten	32,500	28 567	1,009	2.291	5.279	18,711	1,277
Dung excreted (2087)	46,090	9,162	608	968	3 346	3,770	470
Total digested		19,405	401	1,323	1.933	14,941	807
Digested from hay		5,222	198	122	1,837	2,838	222
Digested from grain		14,183	203	1,201	96	12,103	585
Per cent. digested from grain		92.82	62.66	73.95	32.72	98.70	75.99
Average for 2 horses		88.39		75.57		95.72	73.10
Pounds digestible in 100 lbs. of corn meal		77.2		7.0		67.0	3.2

Giving a nutritive ratio of 1:10.6.

Bringing the results as given above together to facilitate comparison, Table XX is obtained.

Table XX.—Summary of Results of Digestion Tests With Shelled Corn and Corn Meal.

	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.	Nutritive ratio.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Digestion co-efficients....	.....	.....	.....	.....	.....	.....	.....
Shelled corn (average)...	74.4	26.3	57.8	.....	88.2	47.7	.....
Corn meal (average).....	88.4	.....	75.6	.....	95.7	73.1	.....
Young horse (No. 1.) Shelled corn....	78.1	32.0	75.8	.....	91.6	52.5	.....
Young horse (No. 1.) Corn meal.....	84.0	.....	77.2	.....	92.7	70.2	.....
Old horse (No. 2.) Shelled corn....	70.8	20.5	39.8	.....	84.8	42.9	.....
Old horse (No. 2.) Corn meal.....	92.8	62.6	74.0	32.1	98.7	76.0	.....
Quantity available in 100 lbs. of:	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Shelled corn.....	57.9	0.3	4.9	.....	54.9	1.9	1:12.1
Corn meal.....	77.2	.....	7.0	.....	67.0	3.2	1:10.6

All the figures in the above tables show a decided advantage in favor of the corn meal over shelled corn. The horses had a better appetite when fed the meal, and digested considerably more. Especially is this true with the older horse.

In the above tables will be noted that in most instances there has apparently been no crude fiber digested in the grain; in fact, not enough digested to meet the calculated requirements of hay. These results agree with those of Wolff and Kreuzhage (Landus Johrb. Vol. 24, 1895, pp. 125-271) and are to the effect that concentrated foods often decrease the digestibility of the crude fiber in the hay. In this experiment there was actual digestion of the crude fiber in the total ration, but a very evident decrease in the digestible fiber in the hay. This seems greater than would ordinarily be indicated, owing to the relatively small amount of fiber in corn and the large amount of the other carbo-hydrates. A calculation of the amount of digestible fiber in the rations gave 28.7 per cent. for the shelled corn period and 39.6 per cent. for the corn meal period.

A comparison of the coefficients obtained for oats and corn shows the protein and fat of the oats to be more easily and apparently better digested than in corn, while the total digestible matter and digestible nitrogen free extract matter to be greater in corn than in oats.

The following table gives the relation between the nitrogen assimilated and excreted, but the results do not in all cases correspond to the weights of the animals:

Table XXI.—Showing Nitrogen, Assimilation and Excretion.

	Quantity of Urine. Grams.	Per cent. Nitrogen.	Quantity of Nitrogen in Urine. Grams.	Quantity of Nitrogen Assimilated. Grams.	Difference. Grams.
		In Shelled Corn Ration.			
Horse 1...	15,050	0.88	132.4	180.8	Gain.. 48.4
Horse 2.....	9,890	1.15	113.7	101.0	Loss.. 12.7
		In Corn Meal Ration.			
Horse 1.....	6,780	1.22	82.7	190.1	Gain..107.4
Horse 2.....	13,910	1.39	193.3	211.7	Gain.. 8.4

In the following table is given the digestion coefficients obtained for corn with horses and ruminants both in America and Germany; from which it will be seen that the variations with the two classes of animals is not so great as in the case of oats. The results in this average a little lower than those of the German experimenters, but the difference is not much.

Table XXII.—Comparison of the Digestibility of Corn by Horses and Ruminants.

	Dry substance.	Protein.	Crude fiber.	N-free extract.	Fat.
Corn meal—Horses	88.4	75.6	.....	98.7	73.1
Corn meal—Ruminants ..	88.0	60.0	.....	93.0	92.0
Shelled corn—Horses ...	74.4	57.8	.....	88.2	47.7
Corn by pigs—Wolff.....	....	85.0	34.0	94 0	76.0
	....	78.0	100.0	94.0	63.0

V.—THE DIGESTIBILITY OF THE NEW CORN PRODUCT BY HORSES.

The new corn product is corn fodder from which the pith has been removed, and it may include the husks and blades, but generally not. In the process of separation the stalks are cut in small pieces and the pith removed, after which the balance is ground into a coarse meal, which in general appearance resembles coarse bran or dried brewer's grains.

The new corn product is subject to about the same variations in quality and composition as corn fodder generally, owing to differences in the quality of the material which is used in its manufacture and the thoroughness with which the pith is removed.

The following table will give some idea of the quality of the different samples which have been used at this Station:

Table XXIII.—Composition of New Corn Product.

Description of Sample.	Water.	Ash.	Protein.	Crude fiber.	N-free extract	Fat.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Material used in digestion experiments, steers (Bulletin 43)	9.22	4.00	6.38	28.70	48.86	2.84
Sample from carload from Owensboro, Ky., factory.	8.45	2.98	4.20	36.30	45.91	2.16
Sample from carload from Owensboro, Ky., factory.	6 42	2.96	4.38	36.66	47.12	2.96
Material used in digestion experiments with horses.	8.51	5.41	6.56	27.30	49.30	2.92
Sample from carload from Rockford, Ill., factory...	11.60	5.13	4.38	30.70	45.95	2.24

In the digestion experiment the ration fed was ground oats and the new corn product. The aim in starting out was to have the horses eat these in the same proportion as hay and ground oats had been consumed in a previous test, but they would not eat as much of the corn product as hay. The ground oats and corn product were mixed and wet with water, and fed as mixed feed. In feeding the new corn product it is always best to wet it to prevent the animals from blowing it out of the trough, and also to make it more palatable.

The following table gives the details of the materials consumed and excreted:

Table XXIV.—Ration, New Corn Product and Ground Oats.

		Horse No 1.	Horse No. 2.
Length of preliminary period		9 days.	9 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	New corn product	21,750	29.250
	Grain	21,000	29 250
	Water drunk	40,999	82.410
	Water in mixed feed	40,620	53.590
Food consumed in digestion period.	New corn product	14 750	16 750
	Grain	14,750	16,750
	Water drunk	41,810	40,880
	Water in mixed feed	24,910	33,500
Excrement	Dung	37,020	59,580
	Urine	12,075	16,520
Weight of horses	At beginning of experiment	832 lbs.	935 lbs.
	At end of experiment	833 "	940 "

Taking the data in the above table and the composition of the feeds and excreta and making the necessary calculations, the results as given in Table XXV are obtained:

Table XXV.—Digestibility of the New Corn Product by Horses.

Rations Fed—The New Corn Product and Ground Oats. (Length of Digestion Period—5 Days.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
N. c. p. eaten (2114).....	14,750	13,496	798	968	4 027	7 272	431
Grain eaten (2049).....	14 750	13,484	533	1,949	1 299	8 759	944
Total eaten.....	29,500	26,980	1,331	2,917	5 326	16,031	1,375
Dung excreted (2093)....	37 020	9,144	981	652	2,469	4,616	426
Total digested.....	.....	17,836	350	2,265	2,857	11,415	949
Digested from oats.....	.....	9,830	51	1,587	8	7,462	744
Digested from n. c. p.....	.....	8,006	299	678	2 849	3,853	205
Per cent digested from n. c. p.....	.....	59.32	37.47	70.04	70.75	54.37	47.56
Horse 2.							
N. c. p. eaten.....	16,750	15,325	906	1,099	4 574	8,257	489
Grain eaten.....	16,750	15,312	605	2 213	1,476	9,946	1,072
Total eaten	33,500	30 637	1,511	3,312	6,050	18,203	1,561
Dung excreted.....	59,580	12,418	1,162	751	3,879	6 286	340
Total digested.....	.....	18,219	349	2,561	2,171	11,917	1,221
Digested from oats.....	.....	12,028	295	1,846	415	8,653	869
Digested from n. c. p.....	.....	6,191	54	715	1,756	3,264	352
Per cent. digested from n. c. p.....	.....	40 40	5.96	65.05	38.39	39.53	72 00
Average for 2 horses.....	.....	49.86	21.72	67.54	54.57	46 95	59.78
Pounds digestible in 100 lbs. of the new corn product.....	.....	45.6	1.3	4.4	14.9	23 2	1.8

Giving a nutritive ratio of 1:9.57 for the new corn product.

Bringing the figures obtained for timothy hay together with those given above, we have the following:

Table XXVI.—Per Cents Digestible

	Dry sustance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Timothy hay.....	45.5	34 0	21.2	42.6	47.3	47.3
New corn product..	49.9	21.7	67 5	54.6	47.0	59.8

Calculating from these digestion coefficients and the composition of the foods, the following are obtained as the amounts of the several ingredients which can be gotten by the horse from one hundred pounds of the respective foods:

Table XXVII.—Pounds Digestible Matter in 100 Pounds.

	Dry substance or Total Digestible matter.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Timothy hay.....	38.6	1 5	0.9	14.1	20.4	1.6
New corn product...	45.6	1.3	4.4	14.9	23.2	1.8

From these figures it will be seen: 1st, that in one hundred pounds of the new corn product there was seven pounds more matter digestible than in one hundred pounds of timothy hay; 2nd, that the new corn product showed nearly five times as much protein digested by the horse as timothy hay; 3rd, that there was but a small difference in the digestibility of the crude fiber, nitrogen free extract and fat, but the difference was slightly in favor of the new corn product.

Comparison of the digestibility of the new corn product by horses and ruminants is given by the following figures:

Table XXVIII.—Comparative Digestibility by Horses and Ruminants.

	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.	Nutritive ratio.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
By horses.....	49 9	21.7	67.5	54.6	47.0	59 8	
By steers.....	63.5	48 7	59.7	60.5	65.8	82 8	
Pounds in 100 lbs.	Lbs	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
By horses	45.6	1.3	4.4	14.9	23.2	1.8	1:9.6
By steers.....	57.6	1.0	3.8	27.3	32 2	2.4	1:14.4

From which it will be seen that the difference in digestibility by the two classes of animals is about the same relatively, as excreted in the case of hay, and that with horses showed, as a whole, a poorer digestion than steers, yet the protein was digested a little better by the horse.

The form in which the new corn product comes upon the market makes it adapted for horse feeding in many places where it is now impossible to get and feed hay, or inconvenient to carry. Again, if this product

proves to be well adapted for horses under all conditions, its form will make it possible to feed a complete and well balanced ration with about half the labor ordinarily required.

Numerous efforts have been made to obtain a condensed ration for army uses, but in most part they have been forced to be confined to the grain only; but these failed because of the lack of hay or something to take its place. Nevertheless the test made by both the Swiss and Italian Armies showed compress grain to have the advantage of keeping longer, requiring less space, of being able to be pressed into uniform rations which makes the task of distribution and feeding easy.

The condition of the new corn product is such that it can be uniformly mixed with the ground grains, and it is superior to the grain in keeping quality, and its use would permit of compounding and compressing uniform rations for army purposes. This sort of ration would overcome the difficulties which officers now experience when in districts where hay cannot be procured, or when on forced marches. Also, such a ration could be fed from a nose bag.

VI.—MIXED FEEDS FOR HORSES.

Taking it literally, the term "mixed feed" would mean a combination of two or more foods, no matter whether it be two or more grains, hays, or grains and hays; but technically speaking, the term "mixed feed" means a mixing of the grain and hay through the aid of water so that the whole presents a uniform appearance and is in a form which must be eaten as though it was but a single substance. This is the common practice of the English farmer in feeding both horses and cattle, and the great economy of the system of cutting the fodder for horses and mixing the ground grain with it has been so well recognized for so many years that this has become the basis of the system in operation for feeding large numbers of horses on stage and car lines, and of cab horses both in this country and in Europe. As relating to the practical side of this question, consider the following, as given on page 377 of "Feeding Animals" by E. W. Stewart:

"We shall now consider the practical rations established in this country, as applied to large numbers of horses devoted to special work. The establishment of street railroads in cities has given steady and exacting employment to many thousands of horses. The cost of feeding so many animals has been the large item which has called for careful study to determine the most economical ration consistent with highest efficiency of service. Many experiments were made with various kinds of grain, and various methods of preparing the ration. Hay was fed long, and the grain, ground or whole, fed alone; but it was soon found that much more long hay was required than when cut into short lengths, and the ground grain fed upon the hay. Their experience was similar to that of the London Omnibus Company, many years ago. This company had 6,000 horses, and determined to test the relative value of cut and uncut hay, as well as ground and unground grain. To this end 3,000 horses were fed ground oats, cut hay, and straw; and 3,000 were fed upon uncut hay and unground oats. The allowance to

the first was—ground oats, 16 lbs.; cut hay, 7½ lbs.; cut straw, 2½ lbs.; To the second was allowed—unground oats, 19 lbs.; uncut hay, 13 lbs. The horses which had 26 lbs. of ground oats, cut straw and hay, did the same work as well, and kept in as good condition as those that had 32 lbs. of unground oats and uncut hay. * * * The result of a ration applied to 3,000 horses must be accepted as an unquestionable fact."

Again, in speaking of corn as a food for horses, Stewart says:

"But as the object of grinding is to reduce the grain to such fine particles that the digesting fluid may saturate and completely act upon it in the shortest time, the value of grinding is in proportion to the fineness of division. And when this finely-ground corn-meal is mixed with a little more than half its weight, but several times its bulk, of cut hay, as above described, this fibrous hay so completely separates the particles of meal as to form a spongy, porous mass, that fluids will pass through freely."

"Indian corn is the great food crop for animals in this country, and is produced in nearly every county of every State, and probably more cases of horse cholic arise from feeding corn-meal than from all other food combined; and this especially occurs among farm horses, because farmers study the philosophy of foods very little, or the effect of condition in foods upon animal health. They feed what is most convenient and cheapest without considering that any good food can be other than healthy. We have known of the death of at least a dozen horses which, on examination, proved to be caused by feeding corn-meal alone. Some feed wet and others dry. But, when fed alone, it is more dangerous wet than dry, because the wet meal may be swallowed with very little mastication, while the dry meal must be masticated till the saliva saturates it before it can be swallowed, and the saliva assists digestion. It is, therefore, in better condition for digestion when fed dry than wet. But four of those who had lost horses by feeding meal alone, when they changed the system and fed the meal upon cut hay, moistened, so that both must be eaten together, had no further losses or even illness of their horses."

Considering these figures and the fact that farmers now have facilities for grinding and cutting feeds, it should become the common practice to feed "mixed feed." The new corn product is in a shape well adapted for making a "mixed feed," and still farther, it is in such a form that it may be made up with grains into a uniform mixture, and consequently large quantities can be mixed at once, which would reduce the labor of making a "mixed feed" at feeding time, to a minimum. In order to test the efficiency of such a composition of horse rations, and to test still further if American digestion coefficients obtained in most part with ruminants will hold out in practice when applied to horses, the following ration was made up with the new corn product as a base and replacing hay:

New corn product	50 parts.
Hominy chop	10 "
Ground oats	10 "
Ground rye	10 "
Linseed meal	10 "
Gluten meal	5 "
Wheat bran	5 "
Total	100 "

The amount of food consumed and the quantity of excreta during this period is given in Table XXIX.

Table XXIX.—Ration, Complete and Well Balanced Ration With New Corn Product Base.

		Horse No. 1.	Horse No. 2.
Length of preliminary period		9 days.	9 days.
Length of digestion period		5 days.	5 days.
		Grams.	Grams.
Food consumed in preliminary period.	Grain	51,500	62,000
	Water drunk	57,020	161 995
	Water in mixed feed	50,800	62,000
Food consumed in digestion period.	Grain	30,000	37,500
	Water drunk	40,330	47,180
	Water in mixed feed	20,000	37,500
Excrement	Dung	36,800	66,500
	Urine	12,760	19 270
Weight of horses	At beginning of experiment.	833 lbs.	940 lbs.
	At end of experiment	860 "	960 "

From which, by means of the composition of the ration, the digestibility, as given in Table XXX is calculated.

Table XXX.—Digestibility of the Components of a Complete Ration with the New Corn Product Base, by Horses.

(Length of Digestion Period—5 Days.)

	Fresh substance.	Dry substance.	Ash.	Protein.	Crude fiber.	N-free extract.	Fat.
Horse 1.	Grams	Grams	Grams	Grams	Grams	Grams	Grams
Total eaten (2121)	30,000	26,721	1,296	3,873	5,025	14,967	1,560
Total excreted (2105)	36,800	9,668	1,097	776	3,084	4,299	412
Digested	.....	17,053	199	3,097	1,941	10,668	1,148
Per cent. digested	.....	63.82	15.35	79.96	38.66	71.28	73.60
Horse 2.							
Total eaten (2121)	37,500	33,401	1,620	4,841	6,281	18,709	1,950
Total excreted (2111)	66,500	12,912	1,224	1,004	4,168	6,044	472
Digested	.....	20,489	396	3,837	2,113	12,665	1,478
Per cent. digested	.....	61.34	24.45	79.26	33.65	67,70	75.80
Average for 2 horses	.....	62.58	19.90	79.61	36.16	69.49	74.70
Pounds digestible in 100 lbs	.....	55.7	0.8	10.3	6.0	34.7	3.9
Theoretical	.....	.....	.....	9.5	48.9		3.7

Nutritive Ratio Found:—1:4.8.

Theoretical Nutritive Ratio:—1:5.9.

The results obtained in this test showed such a ration to be eaten better by the horses than either the ration of ground oats and new corn product or of ground oats and timothy hay. The digestibility of the nitrogen was found to be a little greater than according to theory and the carbohydrates less than according to theory, which made the ration give a narrower nutritive ratio than was calculated.

The following figures give the nitrogen assimilation and excretion in this and the preceding test:

Table XXXI.—Nitrogen Excretion and Assimilation in the New Corn Product Rations.

	Quantity of Urine. Grams.	Nitrogen. Per cent.	Quantity of Nitrogen in Urine. Grams.	Quantity of Nitrogen Assimilated Grams.	Difference. Grams.
			In Ground Oats and New Corn Product Ration.		
Horse 1	12,675	1.24	157.	362.4	Gain..205.2
Horse 2	16,520	1.64	270.9	409.7	Gain..138.8
			In Complete New Corn Product Ration.		
Horse 1	12,760	1.85	236.0	495.5	Gain..259.5
Horse 2	19,270	1.94	373.8	614.0	Gain..230.2

The gain of nitrogen assimilated in these rations over that excreted agrees, in a measure, with the weights recorded for the animals, but the gains in nitrogen and weights do not account for each other.

PROPORTIONS OF GRAIN AND HAY AND FEEDING STANDARDS FOR HORSES.

In studying the proportions of hay and grain fed horses it is not possible to give much consideration to the pratices of the American farmer X, as his methods, to say the least, are very indefinite, and in most cases will be found extremely wasteful. It is not uncommon to find a farmer feeding more grain than necessary, and it is the rule to feed much more hay than is really required, following these customs simply because he has them in abundance, and he takes no account of what is wasted by the animals. Probably the best guide in this matter on record is the investigation conducted by the American Institute Farmer's Club, as to the methods employed in large stables in New York City. They found that feeding the hay and grain as "mixed feed" was the general practice, and the method considered to give the best results. They also found that horses could be worked hard and kept in good condition on cut hay and corn meal. In practice they found the amount of hay fed varied from 8 to 14 lbs. per day in different stables, and of grain from 7 to 20 lbs. per day; the conclusion from the general average was that 10 lbs. of hay per day was sufficient for work horses, and grain from 15 to 18 lbs. per day.

The standard ration in the U. S. Army is 14 lbs. of hay per day and 12 lbs. per day of either oats, corn, or barley. This standard, I suppose, has been arrived at from the amounts used in practice, but the general observation has been that the hay allowance is greater than the horses will consume when on ordinary duty. A large lumberman, who keeps a great many horses for use in lumber wagons, &c., in speaking of this subject said, "that it had been their custom for a number of years to allow 12 lbs. per day for each horse, but had finally cut the amount down to from 6 to 8 lbs. per day, with the result that the horses did rather better, which he attributed to the fact that they would get more rest by this practice than when large quantities were fed and the horses would stand up and continue eating for the greater part of the night." These facts and experiences seem to corroborate the views of Spooner as given in his discussion of rations for horses where he says that "It seems evident that horses were intended by nature to consume concentrated food such as grain." And further it may be drawn from what he says that only the most nutritious bulky foods of good quality should be fed, and even these in but limited quantities to work animals.

THE FEEDING STANDARDS.

The German standard for horses heavily worked is to have a ration furnishing 2.3 lbs. digestible protein and 14.3 lbs. digestible carbohydrates and fat per day, which gives a nutritive ratio of 1:6.2. The standard of the U. S. Army of 14 lbs. of hay and 12 lbs. of oats per day, which is based on the requirements for heavy service, when estimated by the coefficients found in these experiments, would furnish 1.44 lbs. digestible protein and 12.93 lbs. digestible carbohydrates and fat, having a nutritive ratio of 1:9.0.

The German standard for horses lightly worked is 1.5 lbs. digestible protein and 10.4 lbs. digestible carbohydrates and fat per day, having a nutritive ratio of 1:6.9. From this we might conclude that if the German standard was applicable to our conditions, then our Army ration is not strong enough for heavy service work, and for light duty work there is a wasteful amount of the carbohydrates used, which in the bulky hay feed is not desirable for horses if it can be avoided.

Carrying out the same line of discussion with the average proportion arrived at from investigation of the American Institute Farmer's Club, there would be furnished by a ration of 10 lbs. of hay and 18 lbs. of oats, 2.1 lbs. of digestible protein and 11.5 lbs. digestible carbohydrates, having a nutritive ratio of 1:6, which would approximate the German standard for heavily worked horses. Should corn meal be substituted for the oats, as found in many cases, the ration would furnish 1.35 lbs. digestible protein and 17.20 lbs. digestible carbohydrates and fat, which would have a nutritive ratio of 1:13.6. This ration is deficient in nitrogen according to the German standards, but has considerable more carbohydrates. While it is being fed in practice to many horses in the United

States with fairly good results, at the same time the average life of a horse in the service of the cab and car companies, from which this data was obtained, was only about four years, which is entirely too short; and if the horses had received more nutritious food, especially more nitrogenous matter, it is quite probable they would have shown better endurance. The whole question of standard for horses is one that needs further investigation before the subject of horse feeding can be intelligently handled for American conditions.

TEST OF THE NEW CORN PRODUCT AS A SUBSTITUTE FOR HAY.

After the showing which the new corn product made in the digestion tests, and owing to the many ways and places where such a material could be utilized where it is now either too expensive or impracticable to use hay, it was determined to conduct further experiments with this product, and submit it to a test covering longer periods with more animals, and subjecting the horse to work. The work which was demanded of the horses was rather of a spasmodic character, and was such that there was no means for estimating the amount of it accurately; but was in amount and degree such as farm horses are generally required to perform.

There have been nine different horses used in making this test, including the two used for the digestion work. A record of this test will be given in the following pages:

TEST OF GROUND OATS AND TIMOTHY HAY vs. GROUND OATS AND NEW CORN PRODUCT.

This is the portion of the work conducted in connection with the digestion experiments, and is simply a summary of the observations for that time on those two horses. The horses were fed for two weeks on each of the rations indicated, and received the same care and exercise: the rations were only expected to serve for maintenance, and no work was demanded of the animals.

The following are the amounts of food eaten and the weights of the horses:

Length of Periods—14 Days Each.

	Horse No. 1.	Horse No. 2.
Timothy hay consumed	113 lbs.	123 lbs.
Grounds oats consumed	96 "	116 "
Total food	209 "	239 "
Weight at beginning of period	856 lbs.	946 lbs.
Weight at end of period	856 "	951 "
New corn product consumed	80 lbs.	101 lbs.
Ground oats consumed	79 "	101 "
Total food	159 "	202 "
Weight at beginning of period	832 lbs.	935 lbs.
Weight at end of period	833 "	940 "

(Note:—These periods were not consecutive, but had several other periods intervening when the loss in weight occurred.)

From these figures it will be noticed that both rations maintained the animals in their normal condition, but that there was considerable less eaten when on the new corn product ration. These periods were quite short, and consequently the results are only indicative, and would need to be confirmed by covering longer times.

TEST OF WORKING RATIONS.

To test the use of the new corn product as long forage for horses heavily worked, four farm horses were used from February 15th to March 15th. These horses were doing heavy hauling and farm work nearly every day of the entire time. These animals had been receiving, previous to this trial, 12 to 15 lbs. per day of timothy hay, and 15 to 18 lbs. per day of a grain mixture made of corn, oats, wheat bran and linseed meal, or a total of 27 to 30 lbs. per day. The ration used during the test was the following mixture:

New corn product	35 parts.
Hominy chop	25 "
Ground oats	10 "
Ground rye	10 "
Linseed meal	10 "
Gluten meal	5 "
Wheat bran	5 "
	100 "

This mixture would have approximately a nutritive ration of 1.6, and 20 lbs. would furnish approximately 2 lbs. digestible protein and 12 lbs. digestible carbohydrates.

The animals ate of this mixture from 18 to 24 lbs. per day. It was fed wet as mixed feed.

The weights were as follows:

	No. 3. Lbs.	No. 4. Lbs.	No. 5. Lbs.	No. 6. Lbs.
At beginning of test	1,274	1,314	1,314	1,230
At end of one month	1,280	1,320	1,314	1,236

On June 19th, two other horses were put on the same ration as given on page 36, and subjected to various conditions. They ate from 15 to 20 lbs. per day of this mixture, it being fed wet as mixed feed.

Horse No. 7 was either at rest or only light exercise, as she could not be driven.

Horse No. 8 was put on heavy farm work—mostly cultivating, but some wagoning, hay raking, &c.

	Horse No. 7. Lbs.	Horse No. 8. Lbs.
Weights at beginning	1,198	1,158
Weights at end of six weeks	1,214	1,160

Horse No. 7 was disposed of, and another one that would work with No. 8 put in her place. On August 2nd, these two horses were put on the same grain ration as the other horses on the farm, which consisted of a mixture of corn, oats, wheat bran and linseed meal. This grain ration was fed dry and by itself, and they were fed the new corn product wet and by itself instead of hay. The horses during this month were at either light work or driving. They ate 12 to 16 lbs per day of the grain, and 10 lbs. per day of the new corn product. The following were the weights:

	Horse No 8. Lbs.	Horse No. 9. Lbs.
Weight at beginning of test	1,160	1,184
Weight at end of one month	1,176	1,246

During September the horses were placed on the following mixture:

New corn product	50 parts.
Corn meal	15 "
Ground oats	15 "
Ground rye	7½ "
Linseed meal	5 "
Gluten meal	7½ "
	100 "

This mixture has approximately a nutritive ratio of 1:7, and was a little different in its make up from that previously tried. It was fed as

a "mixed feed," and the horse ate about the same quantities as in former periods. The weights are as follows:

	Horse No. 8.	Horse No. 9.
	Lbs.	Lbs.
Weight at beginning of month	1,176	1,246
Weight at end of one month	1,204	1,270

During October the ration fed consisted of:

New corn product	10 parts.
Corn meal	6 "
Oats	3 "
Gluten meal	3 "
Total	22 "

This ration, it will be noticed, contained relatively less fodder than was in previous mixtures, but the amount is more nearly the proportion that was consumed during the August period and that which is used of hay.

	Horse No. 8.	Horse No. 9.
	Lbs.	Lbs.
Weight at beginning of month	1,204	1,270
Weight at end of month	1,200	1,275

During November the ration given was new corn product for long forage and a mixture of oats, rye, linseed meal and gluten meal as the grain portion.

	Horse No. 8.	Horse No. 9.
	Lbs.	Lbs.
Weight at beginning of month	1,200	1,275
Weight at end of one month	1,230	1,330

SUMMARY AS TO THE NEW CORN PRODUCT FOR HORSES.

In all, nine different animals have been fed on rations with the new corn product as a substitute for hay, and the only difficulty that has been experienced in feeding it was with two horses who had other horses beside them to whom hay was being fed. These animals became sullen and refused their feed, but on their next door neighbors being placed on the same ration they were receiving, all went along smoothly. All of these horses had been somewhat accustomed to a "mixed feed," so this form of ration was not so new to them as it would be perhaps to many horses. The horse that relished this form of ration best at the start was one that had been accustomed to eating wet brewer's grains,

which would confirm the observation that in feeding animals there is much in habit and custom. Those who would attempt to feed this material for the first time had probably better start in by feeding the same hay and grain which the horses had been eating as a "mixed feed," and then after accustoming them to that, change to the other. From the fact that the horses ate this feed continuously for five months, and relished it more at the end than at the beginning, seemed satisfied at all times, together with the testimony of the weights is sufficient data for concluding that the new corn product is a good food for horses, and can replace hay for that purpose.

SUMMARY OF PRINCIPAL RESULTS.

1.—Timothy hay proved to be less digestible by horses than by ruminants.

2.—Grinding oats increased their digestibility.

3.—Corn meal was considerably more digestible than Shelled Corn.

4.—Feeding Concentrated Foods or grain with hay, decreased the digestibility of the hay.

5.—It is impossible to maintain horses on a grain ration alone; they must have a long forage.

6.—Making a "mixed feed," of the grain and long forage is the best manner of feeding horses.

7.—The new Corn Product was better digested by horses than Timothy Hay.

8.—Grinding fodder to the condition of the new corn product or of coarse bran does not destroy its value as long forage.

9.—The New Corn Product was successfully used as a substitute for hay in horse feeding.

CONTENTS OF BULLETIN No. 51.

Errata:- Tenth Annual Report, page 164, line 8; read January 1st, instead of June 30th.

Bulletin No. 50 is the first bulletin in the 11th year of the Station, and begins the 11th volume; consequently its present paging is incorrect, and should have started at page 1, instead of 161. Those who bind the bulletins please note this correction.

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 52.

SPECIAL ISSUE.

COMPOSITION OF

COMMERCIAL FERTILIZERS

SOLD IN THIS STATE.

COLLEGE PARK, MD.

FEBRUARY, 1898.

MARYLAND

Agricultural Experiment Station.

ADVISORY COMMITTEE OF BOARD OF TRUSTEES.

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HON. MURRAY VANDIVER .....Havre de Grace.
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CLARENCE W. DORSEY.....*Assistant Physicist.*
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ROBERT E. BROWNING.....*Stenographer.*

Located on the B. & O. R. R., 8 miles N. of Washington, D. C.

NOTICE.

NOTE: Under the laws of Maryland, the inspection, sampling and analysis of commercial fertilizers is to be done under the auspices of the Maryland Agricultural College, by the Professor of Chemistry of the College, who is ex-officio State Chemist. The results of these examinations, being agricultural information of value and general interest, will be published, from time to time, as Special Bulletins, from the Maryland Agricultural Experiment Station.

These Bulletins will be mailed, free, to any farmer who asks for them.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

INSPECTION AND ANALYSIS OF

COMMERCIAL FERTILIZERS SOLD IN MARYLAND

BY THE CHEMICAL DEPARTMENT OF THE

MARYLAND AGRICULTURAL COLLEGE.

DR. H. B. MCDONNELL, *State Chemist.*
F. P. VEITCH, B. S., *Assistant Chemist.*
W. W. SKINNER, B. S., *Assistant Chemist.*
J. R. LAUGHLIN, B. S., *Assistant Chemist.*
H. T. WELTY, B. S., *Assistant Chemist.*

The analytical work for this bulletin has all been done in the new chemical laboratory of the College, a view of which is given on the first page. By referring to the plans on page numbered 51 it will be seen that two laboratories, together with a weighing room, with which they both communicate, and an office, are used exclusively for this work. One of the laboratories is used for the determination of phosphoric acid in fertilizers, while the other is used for the determination of potash and nitrogen (or "ammonia") the rest of the building is used for instruction in chemistry.

The greater part—88 or 90 per cent. of the samples analyzed for this bulletin have been drawn by the agents of the College from fertilizers in the hands of manufacturers, agents, transportation companies and farmers. Several agents spend the greater part of the fertilizer seasons traveling over the State for this purpose.

The other 10 or 12 per cent. of the samples are sent in by farmers who have the right, under the law, to send for analysis, samples of fertilizers "which they have purchased for their own use, *provided* they are not interested in the analysis otherwise than as a consumer of the fertilizer." Samples will *not be analyzed* for manufacturers or agents of fertilizers, nor for farmers unless a description of the sample and a certificate that it has been taken according to law, is furnished on the blanks of this Department. These blanks will be sent to farmers for the asking.

In the following table the figures under "Nitrogen," "Potash" and "Phosphoric Acid," indicate percentage or pounds of the respective ingredients in each hundred pounds of fertilizer, giving in parallel columns the amount "found" by analysis and that "guaranteed" by the manufacturer.

(NOTE—The fertilizer Law will be found on the last four pages of this bulletin.)

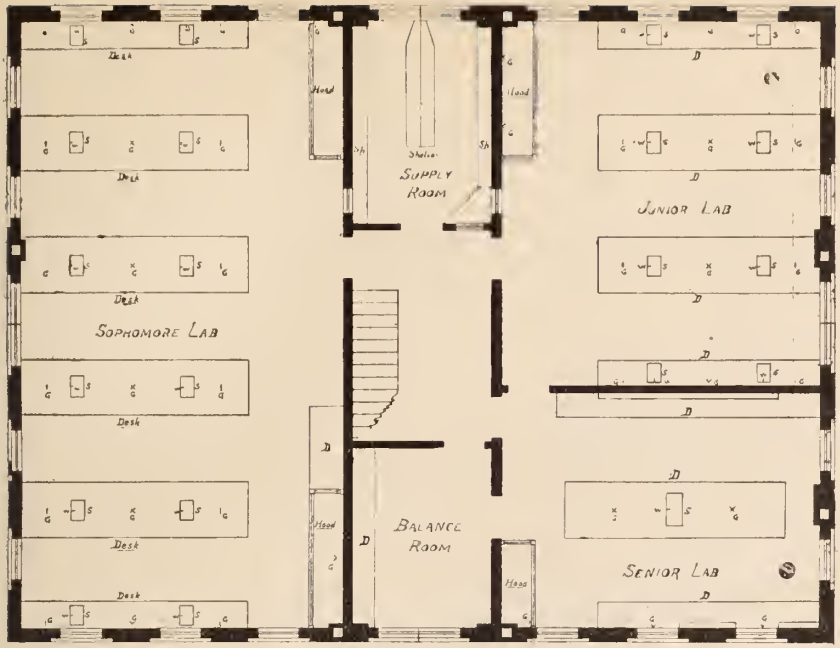
The "number" in the tables is that by which the samples are known in the laboratory, the "comparative value found" and the "comparative value guaranteed" are calculated, the former from the analysis found in the laboratory, the latter from the guaranteed analysis as printed on the bags, using the following schedule:

In Mixed Fertilizer:				
For Nitrogen, calculated as Ammonia	15	cts.	per	pound.
" Potash (K_2O), in forms free from muriate	6	"	"	"
" Potash (K_2O), as muriate	5	"	"	"
" Available Phosphoric Acid	5	"	"	"
" Insoluble Phosphoric Acid	2	"	"	"
" " " when from S. C. Rock	1	"	"	"
In Dissolved S. C. Rock:				
Available Phosphoric Acid	3½	"	"	"
In Ground Bone:				
For Nitrogen, calculated as Ammonia, in "Fine" Bone	14	"	"	"
" Nitrogen, calculated as Ammonia, in "Fine Medium" Bone	12	"	"	"
" Nitrogen, calculated as Ammonia, in "Medium" Bone	10	"	"	"
" Nitrogen, calculated as Ammonia, in "Coarse" Bone	8	"	"	"
" Phosphoric Acid in "Fine" Bone	5	"	"	"
" " " " "Fine Medium" Bone	4	"	"	"
" " " " "Medium" "	3	"	"	"
" " " " "Coarse" "	2	"	"	"
In Tankage:				
For Nitrogen, calculated as Ammonia	12	"	"	"
" Phosphoric Acid	3	"	"	"
In Nitrate of Soda:				
For Nitrogen, calculated as Ammonia	10	"	"	"

The above schedule is a reduction in phosphoric acid of 1 cent a pound in mixed fertilizers and 1½ cent in acid phosphates or dissolved S. C. Rock. This reduction is justified by the prevailing prices of this ingredient.

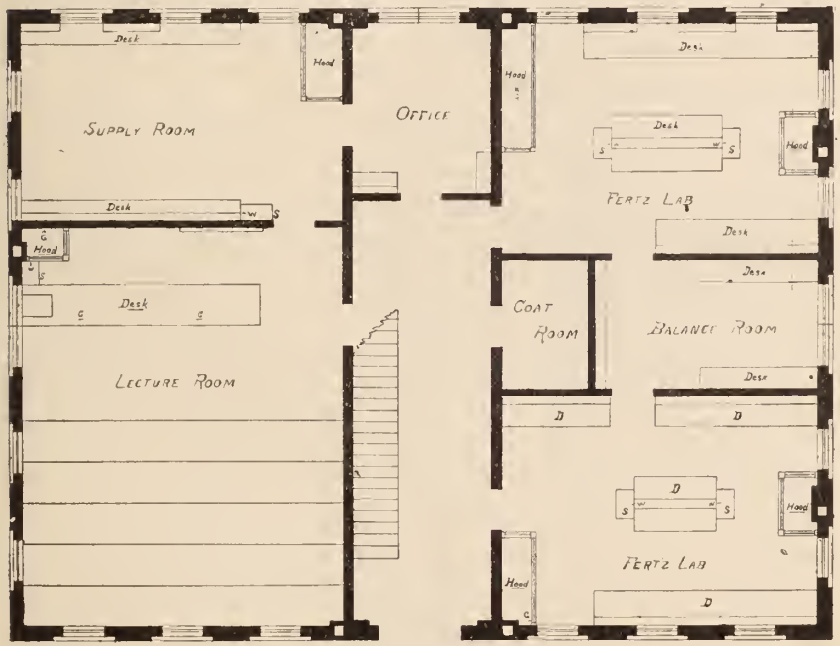
It will be noticed that, under this new schedule, fertilizers with the same analysis as in the previous bulletin are given a lower value.

Too much attention should not be given to these values. They are *not* intended to be the price that should be paid for the goods. For cash in the large markets, they can usually be bought for less. Freights, credits, commissions, etc., will always increase the cost.



G – Gas
W – Water
S – Sink

SECOND FLOOR PLAN



FIRST FLOOR PLAN.

Plans of New Chemical Laboratory, Maryland Agricultural College, 1897.

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4179	Alexandria Fert. & Chem. Co., Alexandria, Va.	Dissolved S. C. Rock...	Willlamsport.....
4181	" " "	Pure Raw Bone Meal....	Hancock.....
4228	A. Anderson & Co., Mt Airy, Md.	Harvest Queen Guano..	Mt. Airy..... .....
4160	E. B. Arnold, Smallwood, Md.	Butcher House Bone....	Westminster.....
4271	Baltimore Guano Co., Baltimore, Md.	Baltimore Special Wheat Mixture.	Secretary Wharf....
4147	" " "	B. G. Ammoniated Bone Phosphate.	Hampstead.....
4270	" " "	Farmer's Alkaline Bone	Secretary Wharf....
4146	" " "	Farmer's Dissolved Bone	Hampstead.....
4195	Baltimore Pulverizing Co., Baltimore, Md.	Anti-acid Phosphate....	Germantown .....
4197	" " "	Crabster's Special Mixture.	Germantown.....
4196	" " "	Farmer's Favorite Fertilizer.	Germantown .....
4127	Baltimore Seed & Implement Co., Baltimore, Md.	Ammoniated Soluble Bone Phosphate.	Baltimore.....
4212	Baugh & Sons Co., Baltimore, Md.	Animal Bone & Potash Compound.	Taneytown.....
4107	" " "	Bone Meal, Warranted Pure.	Baltimore.....
4128	" " "	Dissolved Steamed Bones.	Baltimore.....
4191	" " "	Double Eagle Phosphate	Gaithersburg.....
4110	" " "	Export Bone with Potash	Baltimore.....
4298	" " "	Fertilizer for Wheat and Grass.	Forest Hill.....
4108	" " "	General Crop Grower...	Baltimore.....
4209	" " "	H. G. Acid Phosphate or Dissolved S. C. Rock.	Middletown.....
4041	" " "	Mixture (S. C. Bone and Potash.)	Compton .....
4109	" " "	Old Stand-by Raw Bone Super Phosphate.	Baltimore.....
4182	" " "	Pure Dissolved Animal Bones.	Rockville .....

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4179	.....	.....	.....	.....	.85	14.23	14	15.08	15½	$9.96	$ 9.80
4181	4.92	4	.....	.....	.....	.....	.....	22.41	21½	31.10	.....
4223	1.09	1	1.25	1	3.69	9.73	9	13.42	10	15.73	13.40
4160	1.90	1¾	1.83	1¾	1.08	9.30	8	10.38	.....	17.26	15.00
4271	1.14	1	2.28	2	2.41	9.04	9	11.45	11	15.70	14.00
4147	1.75	1½	2.71	2	2.00	8.17	8	10.17	10	16.93	15.30
4270	.....	.....	2.26	2	2.49	9.37	10	11.86	12	9.32	9.00
4146	.....	.....	.....	.....	.89	15.10	14	15.99	15	10.57	9 80
4195	.....	.....	2.34	1¾	1.12	5.56	5¼	6.68	5½	6.45	5.82
4197	.....	.....	2.41	.....	1.29	7.46	.....	8.75	.....	7.89	.....
4196	.79	1	1.64	1¾	1.88	6.73	5½	8.61	10	11.49	10.60
4127	1.25	1	2.28	1½	1.58	7.48	7	9.06	8	14.14	11.90
4212	2.78	2	2.14	2	3.33	9.05	8	12.38	10½	20.86	17.00
4107	4.74	4	.....	.....	.....	.....	.....	22.21	21½	30.85	.....
4128	2.17	2	....	.....	2.07	18.71	15	20.78	.....	26.05	21.00
4191	2.88	2½	0.94	½	3.11	8.94	8	12.05	10½	19.76	17.00
4110	2.87	2	2.13	2	6 50	8.09	11	14.59	.... ..	21 43	19.00
4298	2.47	2	2.01	2	1.03	9.86	8	10.89	.....	19.69	16.00
4108	1.62	1	1.24	1	2.28	9.14	8	11.42	.....	16.15	12.00
4209	.....	.....	.....	.....	1 41	14.58	14	15.99	15	10.21	9.80
4041	.....	.....	3.20	5	.84	11.78	10	12.62	.....	11.63	12.00
4109	2.34	2	1.09	1	2.59	9.21	8	11.80	10½	18.36	16.00
4182	3.72	3	.....	.....	3.60	14.94	11	18.54	16	27.54	22.00

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4217	Baugh & Sons Co., Baltimore, Md.	Soluble Alkaline Super Phosphate.	Monrovia.....
4305	" " "	Tomato Compound.....	Aberdeen.....
4111	" " "	Wheat Fert. for Wheat & Grass.	Baltimore.....
4260	Beck, Walker & Brown, Chestertown, Md.	Propagator Super Phosphate.	Chestertown.....
4261	" " "	Trustworthy.....	Chestertown.....
4259	" " "	Try Me Super Phosphate	Chestertown.....
4150	Wm. Bender, Jersey City, N. J.	Fertilizer.....	Millers.....
4238	The Berg Company, Philadelphia, Pa.	Raw Bone Fine.....	Elkton.....
4210	A. D. Birely & Sons, Ladiesburg, Md.	Ammoniated Bone Phosphate.	Ladiesburg.....
4211	" " "	Dissolved Bones.....	Ladiesburg.....
4283	Brumfield & Foster, Colora, Md.	Acid Phosphate & Potash.	Colora.....
4284	" " "	Ammoniated Bone Phosphate.	Colora .....
4294	" " "	Hard Times Ammoniated Phosphate.	Colora.....
4282	" " "	H. G. Acid Phosphate..	Colora.....
4178	D. Blocher & Co., Baltimore, Md.	H. G. Super Phosphate of Bone.	Hagerstown .....
4177	" " "	No. 1 Dissolved Bone....	Hagerstown.....
4133	J. Bullock & Son, Baltimore, Md.	Pure Ground Raw Bone.	Baltimore.....
4151	Chemical Co., of Canton, Baltimore, Md.	Baker's Dissolved Bone Phosphate	Alesia.....
4193	" " "	Baker's Special Wheat Com. & Grass Mixture	Gaithersburg .....
4299	" " "	Baker's Standard Ground Bone.	Belair.....
4172	" " "	Dissolved Animal Bone.	Loys.....
3613	" " "	Pure Dissolved S. C. Bone.	Maddox .....
4237	" " "	Pure Dissolved S. C. Bone.	Ellicott City.....

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4217	.....	.....	2.08	2	1.88	10.52	10	12.40	.....	$ 9.81	$ 9.00
4305	2.01	2	2.60	2	3.02	11.16	8	14.18	.....	21.00	16 80
4111	2.54	2	2.18	2	3.46	8.90	8	12.36	11	20.08	16.00
4260	1.01	1	2.80	2	2.42	9.51	10	11.93	.....	16.31	15.00
4261	1.51	1½	2.63	2	1.14	8.94	10	10.08	.....	16.56	16.50
4259	.11	1—	3.01	3	1.73	8.84	10	10.57	11½	9.55	16.60
4150	5.17	5.13	.....	.....	9.52	7.46	8.30	16.98	16.27	26.78	26.88
4238	4.86	4	.....	.....	....	....	.....	23.61	20	28.76	.....
4210	.69	½	1.20	1	2.44	8.41	8	10.85	10	12.66	11.30
4211	2.55	2	.....	.....	2.89	9.74	10	12.63	13¾	18.55	17.50
4283	.....	.....	2.12	2	1.61	11.52	11	13.13	.....	10.50	9.70
4284	2.03	2	1.90	2	1 53	10.32	9	11.85	10	18.92	17.40
4294	1.21	1	1.04	1	1.55	11.60	10	13.15	11	16.89	14.40
4282	.....	.....	.....	.....	.78	14.61	14	15.39	.....	10.23	9.80
4178	1.58	2	1.43	2	2.91	10.20	8	13.11	10	17.53	16.80
4177	1.14	1	.....	.....	1.97	12.40	10	14.37	12	16.61	13.80
4133	6.07	4.92	.....	.....	.....	....	.....	19.08	19.06	30.32	.....
4151	.26	¼	.....	.....	2.00	12.70	13	14.70	15	14.28	14.55
4193	1.70	1	2.50	2	2.54	8.76	9	11.30	11	17.38	14.80
4299	4.23	4	. .	.....	....	....	.....	19.50	20	27.04	.....
4172	2.27	2½	.....	.....	2.83	11.27	12	14.10	.....	19.21	19.50
3613	.....	.....	....	.....	.54	15.38	13	15.92	.....	10.77	9.10
4237	....	.....	.....	.....	1.70	14.01	14	15.71	.....	9.81	9.80

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4161	Chemical Co., of Canton Baltimore, Md.	Red Clover	Westminster
4232	" " "	Soluble Bone and Potash	Ellicott City
4288	R. L. Christy & Co., Colora, Md.	Farmer's Famous Bone Phosphate.	Colora
4287	" " "	Raw and Dissolved Bone Mixture.	Colora
4285	" " "	Soluble Bone and Potash	Colora
4295	" " "	Special for Wheat and Grass.	Rowlandsville
4286	" " "	Unexcelled Acid Phosphate.	Colora
4290	E. A. Clendennin & Bro., Colora, Md.	Farmer's Favorite Vegetator.	Colora
4239	" " "	Fine Ground Bone	Elkton
4292	" " "	H. G. Acid Phosphate	Colora
4289	" " "	National Standard	Colora
4291	" " "	Pure Ground Bone	Colora
4138	" " "	Soluble Bone Phosphate	Baltimore
4180	" " "	T. & P. Super Phosphate	Hancock
4293	" " "	Wheat and Grass Special Compound.	Colora
4296	Josiah Cope, Lincoln University, Pa.	Ammoniated Bone Phosphate.	Conowingo
4124	Edward L. Coulson, Baltimore, Md.	Pure Fine Ground Bone	Baltimore
4202	Crocker Fertilizer Co., Buffalo, N. Y.	H. G. Cereal Guano	Walkersville
4200	" " "	New Rival Ammoniated Super Phosphate.	Adamstown
4203	" " "	Practical Ammoniated Super Phosphate.	Walkersville
4216	Cutshall & Stimmel, Woodsboro, Md.	Ammoniated Bone Phosphate.	Monrovia
4304	Wm. Davison & Co., Baltimore, Md.	Bos Ammoniated Super Phosphate.	Belair
4302	" " "	H G. Ammoniated Super Phosphate.	Belair

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4161	1.10	1	2.11	2	2.25	5.53	5	7.78	6	$11.84	$10.00
4232	.....	.....	2.22	2	1.99	9.69	10	11.68	.....	9.40	9.00
4288	1.37	1	1.87	2	3.41	9.85	8	13.26	10	17.19	13.80
4287	2.43	2½	4.03	4	3.00	10.92	9	13.92	13½	23.44	21.55
4285	.....	.....	1.75	2	2.40	11.87	11	14.27	13	10.54	10.10
4295	2.20	2	1.82	2	2.97	9.05	10	12.02	13	18.66	19.20
4286	.....	.....	....	.....	1.98	14.02	14	16.00	16	9.81	9.80
4290	1.15	1	.83	1	2.11	7.13	8	9.24	9	12.25	12.40
4239	4.75	4	.....	.....	.....	.....	.....	22.46	22	26.41	.....
4292	.....	.....	.....	.....	1.76	14.57	14	16.33	.....	10.20	9.80
4289	1.07	1½	2.03	1½	1.81	7.94	10	9.75	13	13.90	17.20
4291	4.69	4	....	.....	.....	.....	.....	22.27	22	26.20	.....
4138	.....	.....	2.20	2	3.88	8.59	10	12.47	11	8.99	9.20
4180	.....	.....	....	.....	2.22	13.40	16	15.62	.....	9.38	11.20
4293	1.07	1¼	1.54	2	1.80	7.65	9	9.45	.....	13.12	14.75
4296	1.07	1	2.85	2	2.10	10.62	10	12.72	12	17.52	15.80
4124	4.43	.....	....	.....	.....	.....	.....	22.27	.....	29.12	.....
4202	1.22	1	1.68	2	1.16	7.36	8	8.52	9	13.16	13.40
4200	1.58	1½	1.75	1.60	1.40	9.70	10	11.10	11	16.75	16.50
4203	1.31	1	1.52	1	1.87	8.23	8	10.10	9	14.43	12.40
4216	1.02	1	2.13	1	1.36	9.37	8	10.73	.....	15.10	12.00
4304	2.52	2½	2.56	2½	2.06	10.55	8	12.61	11	21.49	19.20
4302	2.98	2¾	3.10	2¾	2.17	12.42	10	14.59	13	25.33	22.20

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4303	Wm. Davison & Co., Baltimore, Md.	Penn Mar Ammoniated Bone Phosphate.	Belair.....
4229	E. E. De Lashmutt, Frederick, Md.	Dissolved S. C. Bone....	Woodbine .....
4205	" " "	Mixture — Ammoniated Bone.	Frederick.....
4206	" " "	Mixture—Fish and Bone	Frederick.....
4207	" " "	Mixture—Soluble Bone..	Frederick.....
4208	" " "	Mixture—Soluble Bone and Potash.	Frederick.....
4269	Lewis F. Detrick, Baltimore, Md.	Bone and Potash Mixture.	Pocomoke .....
4246	" " "	Kangaroo Komplete Kompound.	Baltimore.....
4139	" " "	Orchilla Guano.....	Baltimore.....
4247	" " "	Orchilla Guano and Potash	Baltimore.....
*4035	" " "	Soluble Bone Phosphate and Potash.	Kemptown.....
4267	" " "	XXTRY Acid Phosphate	Snow Hill.....
4244	Detrick Fert. & Chemical Co., Baltimore, Md.	Alkaline Bone.....	Baltimore.....
4145	" " "	Carroll Mixture.....	Hampstead.....
4201	" " "	Dissolved Bone.....	Frederick.....
4198	" " "	Dissolved S. C. Bone....	Barnesville.....
4264	" " "	Emory's Bone and Potash.	Queen Anne's.....
4199	" " "	Farmer's Friend.....	Adamstown .....
4224	" " "	Farmer's New Method..	Mt. Airy.....
4225	" " "	Imperial Compound.....	Mt. Airy.....
4103	" " "	Pure Fine Ground Animal Bone.	Locust Point.....
4228	" " "	Sea Fowl Guano.....	Mt. Airy.....
4230	" " "	Soluble Bone Phosphate and Potash.	Marriottsville.....

*Brand of the Detrick Fertilizer and Chemical Company.

Maryland Agricultural College, August, 1897, to February, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4303	1.80	1.40	2.15	2½	2.81	7.41	8	10.22	10	$16.08	$15 50
4229	.....	.....	.....	.....	.56	15.32	14	15.88	.....	10.72	9.80
4205	1.32	1½	1.71	¾	1.50	10.84	10	12.34	.....	17.11	15.25
4206	1.64	2¼	.92	¾	1.69	11.15	10	12.84	.....	17.67	17.50
4207	.90	¾	.74	¾	1.20	13.35	9	14.55	.....	17.27	12.00
4208	....	.....	1.61	1½	.52	13.74	10	14.26	.....	11.34	8.50
4269	.....	.....	2.26	2¼	1.76	10.82	10	12.58	12½	10.18	9.75
4246	2.07	2	3.37	3	3.86	7.50	8	11.36	11½	18.62	18 40
4139	.....	.....	..	.....	10.97	5.25	.....	16.22	14	5.87	2.80
4247	.....	.....	2.69	3	6.57	6.42	4	12.99	12	8.49	7.40
4035	.....	.....	2.25	2	1.82	10.27	10	12.09	12	9.79	9 40
4267	.....	.....	.....	.....	1.03	14.12	14	15.15	14.75	9.88	9.80
4244	.....	.....	2.39	2	2.93	9.86	10	12.79	12	9.88	9.40
4145	1.36	1	2.04	2	2.20	10.55	9	12.75	10	17.55	14.40
4201	2.37	2½	.....	.....	3.50	10.39	10	13.89	12	18.90	18.30
4198	.....	.....	.....	.....	.71	14.70	14	15.41	15	10.29	9.80
4264	.....	.....	2.82	.....	2.10	9.90	.....	12.00	.....	10.17	.....
4199	1.19	1	1.11	1	3.06	9.26	8	12.32	10	15.16	12.80
4224	2.52	2½	....	.....	2.69	9.78	8	12.47	.....	18.42	15.50
4225	1.10	1	1.04	1	1.93	10.62	9	12.55	10	15.73	13.40
4103	4.81	4	.....	.....	.....	.....	.....	22.76	21½	30.85	.....
4228	2.77	2.90	2.26	2	4.59	9.46	8	14.05	9¾	21.87	19.40
4230	.....	.....	2.10	2	2.50	9.93	10	12.43	12	9.55	9.40

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4226	Detrick Fert. & Chemical Co., Baltimore, Md.	Special Mixture	Mt. Airy
4227	" " "	Vegetator	Mt Airy
4144	" " "	Wheat Fertilizer	Baltimore
4231	J. W. Dorsey, Ellicott City, Md.	"D" Mixture	Ellicott City
*4306	Josh. W. Dorsey, Ellicott City.	Mixture "D"	Ellicott City
4274	Draper, Davis & Co., Milford, Del.	Bone Phosphate, Jumbo.	Linkwood
4273	" " "	Old Reliable XX Raw Bone Super Phosphate	Linkwood
4272	" " "	Rock	Linkwood
4297	P. P. Dunan, Baltimore, Md.	Ammoniated Alkaline Phosphate.	Cambria
4168	D. Englar, Jr., Medford, Md.	No. 1 Bone Phosphate	Medford
4167	" " "	No. 3 Bone Phosphate	Medford
4170	Englar & Rinehart, Linwood, Md.	No. 1 Ammoniated Bone Phosphate.	Linwood
4169	" " "	No. 2 Ammoniated Bone Phosphate.	Linwood
4278	Eureka Fertilizer Co., Perryville, Md.	AlkalineBone and Potash	Kising Sun
4281	" " "	Bone Meal	Rising Sun
4277	" " "	Farmer's Favorite Bone Fertilizer.	Rising Sun
4240	" " "	Fish Rock and Potash	Leslie
4280	" " "	Grain and Grass Mixture	Rising Sun
4241	" " "	Imperial Bone Phosphate	Leslie
4276	" " "	P. & P. Super Phosphate	Rising Sun
4149	Farmer's Fertilizer Co., Westminster, Md.	No. 1 Bone Phosphate	Maple Grove
4157	" " "	No. 2 Bone Phosphate	Westminster

*This is a second brand of the "Mixture D," which was put on the market during the season.

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4226	1.10	1	1.10	1	1.68	10.85	8	12.53	10	$15.92	$12.80
4227	2.46	2½	1.52	1½	4.07	10.45	10	14.52	12	20.98	19.80
4144	1.45	1½	.....		3.05	10.71	10	13.76	11	16.28	14.15
4231	1.85	2¼	2.11	2	1.71	11.36	10	13.07	11½	19.70	19.35
4306	2.29	2¼	2.57	2½	1.99	10.64	10	12.63	11½	20.88	19.85
4274	1.12	1	1.74	1	3.76	9.24	8	13.00	.....	15.84	12.00
4273	1.37	½	1.92	½	4.20	8.63	8	12.83	.....	16.34	10.00
4272	.....	.....	.....	.....	3.79	12.17	.....	15.96	.....	8.52	.....
4297	2.49	2	2.30	1	2.65	10.49	8	13.14	12	21.32	15.80
4168	2.87	2½	1.82	2	3.44	8.77	8½	12.26	11½	20.58	19.20
4167	1.70	1½	2.74	2	1.86	9.31	9½	11.17	11	17.89	16.60
4170	2.53	2½	1.20	1.34	2.21	10.59	11.31	12.80	.....	20.26	20.15
4169	1.02	1.80	2.84	1.83	2.73	8.93	11.99	11.66	.....	15.92	19.22
4278	.....	.....	1.53	2	2.05	11.35	11	13.40	12	9.89	9 90
4281	3.46	3	.....	.....	.....	.....	.....	25.05	25	31.57	.....
4277	1.32	2	3.33	2	3.41	9.64	10	13.05	12	18.29	18 80
4240	.76	½	1.40	½	4 70	7.84	7	12.54	9	13.40	9.80
4280	1.23	1	2.15	2	3.66	9.73	9	13.39	10	17.03	14.40
4241	1.24	1	1.71	1	3.20	9.93	9	13.13	10	16.64	13.00
4276	.....	.....	.....	.....	2.00	13 62	14	15.62	15	9.53	9.80
4149	2.66	2½	2.28	2½	.78	9.44	9	10.22	11	20.01	19.80
4157	2.12	2	1.92	2½	1.11	9.99	9	11.10	10	18.71	17.90

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4156	Farmer's Fertilizer Co., Westminster, Md.	No. 3 Bone Phosphate...	Westminster.....
4155	" " "	Pure Dissolved Bone....	Westminster.....
4148	" " "	XX Bone Phosphate.....	Maple Grove.....
4248	W. S. Farmer & Co., Baltimore, Md.	B. & P. Fertilizer.....	Baltimore.....
4275	" " "	Dissolved S. C. Bone...	Cambridge.....
4137	" " "	Harvest Queen.....	Baltimore.....
4158	N. I. Gorsuch & Son, Westminster, Md.	Westminster Dis. Raw Bone Phosphate.	Westminster.....
4159	" " "	Westminster No. 3 Bone XXXX.	Westminster.....
4171	Griffith & Boyd, Baltimore, Md.	Ammoniated Soluble Bone.	Union Bridge.....
4252	" " "	Ammoniated Bone Phosphate.	White Hall.....
4136	" " "	Cereal Bone Plant Food.	Baltimore.....
4105	" " "	H. G. Acid Phosphate..	Baltimore.....
4134	" " "	Peerless Fertilizer.....	Baltimore.....
4101	" " "	Pure Dissolved Animal Bone.	Baltimore.....
4106	" " "	Pure Fine Ground Bone Meal.	Baltimore.....
4135	" " "	Soft Ground Bone.....	Baltimore.....
4045	" " "	Special Mixture.....	Freedom .....
4233	" " "	Valley Fertilizer.....	Ellicott City.....
4112	Griffith, Turner & Co. Baltimore, Md.	Ammoniated Butchers' Bone Phosphate.....	Baltimore.....
4123	" " "	Animal Bone Phosphate.	Baltimore.....
4115	" " "	Strictly Pure Raw Bone Meal.	Baltimore.....
4164	Hanover Bone Fertilizer Co., Hanover, Pa.	Blood & Bone Compound	Westminster.....
4152	" " "	Hanover Dissolved Bone Phosphate.	Manchester.....

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No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4156	1.87	1½	2.59	2½	1.16	9.78	7	10.94	.....	$18.44	$14.00
4155	2.52	2	....	.....	6.30	9.94	15	16.24	.....	20.02	21.00
4148	1.04	1	3.19	3	1.06	10.13	9	11.19	10	16.86	15.40
4248	.....	.....	2.13	2½	1.94	10.73	10	12.67	11	10.03	9.70
4275	.....	.....	....	.....	2.31	13.07	14	15.38	15½	9.15	9.80
4137	1.63	1½	3.07	2½	1.17	10.10	10	11.27	.....	18.53	17.60
4158	1.48	1.40	2.41	2¼	2.17	8.03	7	10.20	8	15.75	13.85
4159	.39	¼	2.13	1½	2.84	7.20	8	10.04	9	11.64	10.65
4171	1.10	1	1.98	1½	1.68	7.09	7	8.77	8	13.04	11.90
4252	1.95	1	2.44	1½	2.02	10.68	9	12.70	10	20.02	13.90
4136	1.11	1	2.58	2	2.22	8.08	8	10.30	10	14.88	13.80
4105	.....	.....	.....	.....	2.45	12.40	14	14.85	15	8.68	9.80
4134	.35	¼	2.35	2	2.06	7.59	8	9.65	9	11.83	11.15
4101	2.12	2½	.....	.....	3.18	9.21	10	12.39	11	16.84	17.90
4106	5.61	4	.....	...	.....	.....	.....	19.23	22	26.77	.....
4135	4.20	3	....	.....	.....	.....	.....	13.10	11	21.85	.....
4045	.58	½	2.55	2	3.13	7.46	8	10.59	9	13.01	11.90
4233	.53	½	2.50	2	1.80	7.49	8	9.29	9	12.30	11.90
4112	1.54	1½	2.09	1½	2.78	8.31	9	11.09	10	16.13	15.40
4123	2.01	2½	2.70	1½	2.90	9.71	10	12.61	11	19.92	19.40
4115	6.07	4	.....	.....	.....	.....	.....	18.16	23	27.88	.....
4164	1.14	1	2.23	2	1.76	8.61	8	10.37	.....	14.96	13.00
4152	.....	.....	2.30	2	.80	10.90	8	11.70	9	10.09	7.80

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4163	Hanover Bone & Fertilizer Co., Hanover, Pa.	Excelsior Combine.....	Westminster.....
4162	" " "	Farmer's Crop Winner..	Westminster.....
4166	" " "	Pure Bone Meal.	Westminster.....
4301	Hanway & Keen, Belair, Md.	Special Mixture.....	Belair.....
4142	" " "	H. & K. Standard H. G Guano	Baltimore.....
4249	S. M. Hess & Bro., Philadelphia, Pa.	Ground Bone.....	Baltimore.....
4242	" " "	Keystone Bone Phosphate.	Leslie.....
4218	W. H. Hood, Mt. Airy, Md.	Special Mixture.....	Mt. Airy.....
4113	J. Horner. Jr., & Co., Baltimore, Md.	Ammoniated Raw Bone Super Phosphate.	Baltimore.....
4114	" " "	Dis. Slaughter House Bone Dust.	Baltimore.....
4100	" " "	Slaughter House Bone Dust	Baltimore .....
4266	Hubbard & Co., Baltimore, Md.	Climax Super Phosphate	Easton..... .....
4117	" " "	Columbia Gem Phosphate.	Baltimore.....
4265	" " "	Crescent Soluble Crop Producer.	Easton.....
4222	" " "	Dissolved Raw Bone....	Mt. Airy.....
4118	" " "	H. G. Soluble S. C. Bone	Baltimore.....
3622	" " "	Muriate of Potash.....	Reliance .....
4220	" " "	Oriental Phosphate.....	Mt. Airy.....
4194	" " "	Soluble Bone and Potash	Germantown.....
3620	" " "	S. C. Rock.....	Reliance .....
4219	" " "	Standard Bone Super Phosphate.	Mt. Airy.....
3621	" " "	Tankage.....	Reliance .....
4221	" " "	Warranted Pure Raw Bone	Mt. Airy.....

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No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4163	2.06	2	3.35	3	1.65	9.36	9	11.01	10	$19.55	$18.40
4162	.67	½	1.84	1	1.09	8.93	7	10.02	.....	13.22	9.50
4166	4.32	4	.....	.....	.....	.....	.....	15.95	23	23.57	.....
4301	1.42	1	2.29	2	2.55	8.74	9	11.29	11	16.31	14.80
4142	2.67	2½	2.83	2½	2.49	8.57	9	11.06	.....	20.41	19.00
4249	4.98	3	.....	.....	.....	.....	.....	22.10	22	26.81	.....
4242	1.30	1	1.45	1	1.75	7.74	9	9.49	11	13.79	13.80
4218	1.41	1	2.73	2	.69	9.66	8	10.35	9½	16.90	13.60
4113	3.38	2½	1.59	2½	3.16	8.53	8	11.69	12	21.52	19.60
4114	2.81	2½	.....	.....	5.14	11.84	12	16.98	15	22.32	20.70
4100	6.90	6.00	.....	.....	....	.....	.....	19.55	20	32.36	.....
4266	1.12	1	1.53	1½	1.12	9.34	8	10.46	10	14.68	13.30
4117	.92	½	1.70	1½	1.12	10.23	8	11.35	10	15.14	11.80
4265	.....	.....	....	.....	1.44	11.43	10	12.87	11	8.00	7.00
4222	2.79	2¾	.....	.....	4.51	10.15	11	14.66	.....	20.32	19.25
4118	.....	.....	.....	.....	.98	15.16	14	16.14	14	10.61	9.80
3622	.....	.. ....	35.82	52	....	.....	.....	....	.....	.....	.....
4220	1.21	1	1.51	1½	1.06	9.62	8	10.68	10	15.18	13 30
4194	.....	.....	2.14	2	.88	10.47	10	11.35	11½	9.68	9.30
3620	.....	.....	.....	.....	1.48	14.18	14	15.66	.....	9.93	9.80
4219	1.14	2	2.07	2	.87	10.34	9	11.21	10	16.18	17.40
3621	8.05	10	.....	.....	3.39	4.07	.....	7.46	10	23.79	.....
4221	4.55	4	.....	.....	...	.....	.....	23.11	23	27.40	.....

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4116	Hubbard & Co., Baltimore, Md.	Wheat Grower's Jewel..	Baltimore..... ....
4268	M P. Hubbard & Co., Baltimore, Md.	Ammoniated Bone and Potash.	Pocomoke.....
4122	" " "	Harvest King.....	Baltimore..... ...
4121	" " "	Farmer's Old Economy.	Baltimore .....
3616	" " "	Farmer's Old Economy.	Greensboro .....
4255	" " "	Soluble Bone and Potash Phosphate.	Baltimore.... .....
4256	T.R. Hubbard & Son, Chestertown, Md.	Imperial Compound.....	Chestertown.....
4257	" " "	Special Mixture.....	Chestertown.....
4143	T. C. Hunter, White Hall, Md.	Extra Ammoniated Bone Phosphate.	Baltimore .....
4120	S. L. Lamberd Co., Baltimore, Md.	Favorite Fertilizer.....	Baltimore.....
4214	Lazaretto Guano Co., Baltimore, Md.	Alkaline Phosphate.....	Woodsboro..... .
4039	" " "	Alkaline Phosphate.....	Plane No. 4.....
4185	" " "	Ammoniated Bone Phosphate.	Washington Grove..
4236	" " "	Bone Compound.....	Ellicott City.....
4188	" " "	Crop Grower for Wheat and Fall Crops.	Washington Grove..
4234	" " "	Forcythe & Linthicum Mixture.	Ellicott City.....
4213	" " "	Harford Bone.....	Taneytown .....
4250	" " "	H. G. Dis. Bone Phosphate and Potash.....	Baltimore.....
4186	" " "	Pure Dissolved Animal Bone.	Washington Grove..
4215	" " "	Pure Dissolved S. C. Bone.	Woodsboro.....
4235	" " "	Pure Ground Bone.....	Ellicott City .....
4183	" " "	Retriever Animal Bone Fertilizer	Washington Grove..
4176	A. A. Lechlider, Hagerstown, Md.	Eagle Bone Phosphate..	Hagerstown .....

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No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4116	1.74	1½	1.52	1½	1.67	10.82	10	12.49	11	$18.23	$16.40
4268	1.11	1	1.52	1½	.80	9.16	8	9.96	9½	14.33	13.10
4122	1.74	1½	1.98	1½	1.25	10.25	9	11.50	10½	17.95	15.60
4121	.99	1½	1.67	1½	1.39	8.83	8	10.22	10	13.53	11.80
3616	1.05	½	1.54	1½	1.35	9.32	8	10.67	10	11.75	9.40
4255	....	.....	1.74	2	.43	10.63	10	11.06	12	9.27	9.40
4256	1.02	1	2.32	3½	1.24	10.60	9	11.84	10	16.48	15.50
4257	.52	.....	1.88	.....	1.05	9.83	.....	10.88	.....	13.69	.....
4143	1.64	1½	4.08	4	1.39	9.08	8	10.47	.....	18.64	16.50
4120	2.11	2	1.97	1	2.29	7.66	8	9.95	9	16.88	15.40
4214	.....		1.88	2	1.10	11.72	11	12.82	12	10.30	9.90
4039	....	.....	2.07	2	1.17	11.72	11	12.89	... ...	10.49	9.70
4185	1.10	1	2.32	2	1.30	9.80	9	11.10	10	15.94	14.40
4236	1.30	1¼	2.37	2½	1.53	9.74	10	11.27	11	16.62	16 65
4188	2.17	2	2.29	2	1.45	10.12	10	11.57	11	19.50	18.40
4234	2.53	2¼	4.47	4	3.55	10.34	9	13.89	13½	23.82	21.55
4213	3.49	3	.....		.....	.....	.....	17.68	16	22.53	.....
4250	.....		3.28	2	1.00	12.53	12	13.53	.... ..	12.25	10.40
4186	2.72	2½	.....		3.40	13.40	12	16.80	... ...	22.92	19.50
4215	.....		. ..	.....	1.42	14.82	14	16.24	15	10.37	9.80
4235	4.92	4½	....	.....	...	....	.....	22.95	21½	27.73	.....
4183	2.42	2¼	4.10	4	3.60	10.66	9	14.26	13½	23.46	21.55
4176	.51	1½	1.67	1½	1.80	4.31	7½	5.61	9	8.03	14.10

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4175	A. A. Lechlider, Hagerstown, Md.	Soluble Bone Phosphate.	Hagerstown.....
4174	" " "	S. C. Bone.....	Hagerstown.....
4253	Lister Agrl. Chem. Works, Newark, N. J.	Animal Bone and Potash	White Hall.....
4245	" " "	Ammoniated Dissolved Bone Phosphate.	Baltimore.....
4102	" " "	Celebrated Ground Bone Acidulated.	Baltimore.....
4190	" " "	Harvest Queen.....	Washington Grove..
4187	" " "	Pure Raw Bone Meal....	Washington Grove..
4104	" " "	Special Crop Producer..	Baltimore.....
4141	" " "	Special Fertilizer for Wheat.	Baltimore.....
4254	" " "	Special for Wheat and Grass.	Glencoe.....
4184	" " "	Standard Pure Bone Super Phosphate.	Washington Grove..
4182	" " "	Success Fertilizer.....	Gaithersburg.....
4173	Joseph Lister, Chicago, Ill.	Pure Bone Meal.....	Chewsville.....
4154	J. A. Livers, Baltimore, Md.	Gold Dust.....	Westminster.....
4262	T. H. Longfellow, Greensboro, Md.	Farmer's Delight No. 1..	Greensboro, Md....
3615	" " "	Farmer's Delight No. 1..	Greensboro.....
4043	" " "	Farmer's Special Mixture.	Ridgeley..... ...
4038	" " "	Muriate of Potash.....	Greensboro..... ...
3617	" " "	Special Mixture.....	Greensboro.....
4037	" " "	Special Mixture.....	Greensboro.....
4263	" " "	Wheat Grower.....	Greensboro.....
4413	Maryland Fertilizer Co., Baltimore, Md.	Ammoniated O. K. Fertilizer.	Hagerstown.....
4369	" " "	Dissolved S. C. Bone...	Baltimore.....

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No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4175	.39	1	2.18	1	1.82	2.86	6½	4.68	7	$ 6.94	$10.70
4174	.....	.....	1.67	1	1.30	3.33	6	4.63	.....	4.26	5.20
4253	.....	.....	5.03	5	1 36	9.61	9	10.97	10	12.03	11.50
4245	2.23	2.20	2.23	1½	2.27	10.44	9	12.71	10	20.34	17.50
4102	4.13	3¼	....	.....	6.54	7.48	.....	14.02	12	22.49	.....
4190	1.76	1½	2.25	2	1.68	10.77	9½	12.45	11½	19.02	16.80
4187	3.41	3¼	.....	.....	..	.....	.....	24.35	23	27.97	.....
4104	1.18	1	1.22	1	2.93	7.17	7	10.10	8	13.10	11.40
4141	2.13	2	2.10	2	3.04	8.67	8	11.71	.....	18.42	16.00
4254	2.09	2	2.02	2	2.11	10.41	10	12.52	11	19.84	18.64
4184	2.83	2.85	2.05	1½	1.37	12.35	10	13.72	12	23.44	20.85
4192	1.79	1½	2.31	2	1.51	11.76	9½	13.27	11½	20.11	16.80
4173	4.24	4.68	.....	.....	....	....	.....	24 69	25	31.85	.....
4154	1.59	1	2.05	1	1.15	11.08	9	12.23	10½	18.36	13.60
4262	1.20	1	2.48	2	2.48	9.47	8	11.95	9	16.54	13.40
3615	1.37	1	2.62	2	.74	8.92	8	9.66	9	15.95	13.40
4043	2.20	.....	5.83	.....	4.25	8.47	.....	12.72	.. ....	22.50	.....
4038	.....	.....	50.54	.....	.....	.....	.....	.....	.....	40.44	.....
3617	.....	.....	3.85	.....	2.09	12.91	.....	15.00	.....	13.31	.....
4037	.....	.....	4.00	.....	.26	15.25	... .	15.51	.....	14.73	.....
4263	.92	½	1.64	2	1.55	9.39	8	10.94	9	14.41	12.30
4413	1.43	1	2.03	2	2.31	8.32	8	10.63	9	15.56	13.40
4369	.....	....	.....	.....	.91	14.48	14	15.39	14½	10.14	9.80

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4401	Maryland Fertilizer Co., Baltimore, Md.	Globe Complete Manure.	Smithsburg.....
4402	" " "	Sangston's Cereal and Plant Food.	Smithsburg.....
4494	Wm McKenney, Centreville, Md.	McKenney's Compound.	Centreville .....
4445	F. Mehring, Bruceville, Md.	Acid Phosphate.....	York Road .....
4446	" " "	Dissolved Raw Bone....	York Road.....
4447	" " "	Twenty-six Dollar Phosphate.	York Road.....
4368	Miller Fertilizer Co., Baltimore, Md.	Buyer's Mixture.....	Baltimore.....
4484	" " "	Clinch Phosphate.....	Baltimore.... .....
4372	" " "	Dissolved Raw Bone....	Baltimore..... ...
4458	" " "	Dissolved Raw Bone....	Ellicott City . ....
4343	" " "	Ground Bone.....	Baltimore.....
4345	" " "	Ground Bone.....	Baltimore.....
4337	" " "	Harvest Queen..... ...	Baltimore.....
4354	" " "	Hustler Phosphate.....	Baltimore.....
4338	" " "	S. C. Bone.....	Baltimore .....
4366	" " "	Special Wheat Grower..	Baltimore.....
4351	" " "	Standard Super Phosphate of Lime.	Baltimore .....
4336	" " "	W. G. Phosphate.....	Baltimore.....
4399	Geo. W. Miller, Baltimore, Md.	Dissolved Bone Phosphate	Loy's.....
4400	" " "	Miller's Mixture.....	Loy's.....
4398	" " "	Royal Wheat, Corn and Grass Mixture.	Loy's.....
4487	G R. Mowell, Glencoe, Md.	Dissolved S. C. Rock....	Monkton.....

Maryland Agricultural College, August, 1897, to February, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4401	2.03	2	2.38	1½	2.96	8.77	9	11.73	10	$18.42	$16.90
4402	1.32	1¼	2.57	2¼	3.56	10.00	10	13.56	11	17.95	16.40
4494	2.07	1½	1.44	1¼	2.46	9.73	10	12.19	....	18.36	15.75
4445	.....	.....	....	.....	3.00	13.37	14	16.37	.....	9.36	9.80
4446	1.53	1½	.....	.....	1.85	18.19	14	20.04	.....	23.52	18.50
4447	1.52	1	1.24	¾	4.54	12.77	11	17.31	.....	20.39	14.75
4368	.62	½	1.02	1	1.60	7.84	7	9.44	.....	11.36	9.50
4484	1.04	1	2.01	1½	1.76	9.40	7	11.16	9	15.23	12.30
4372	2.62	2½	.....	.....	3.66	8.82	11	12.48	14	18.14	19.70
4458	2.64	2½	.....	.....	4.99	9.78	12	14.87	15	19.70	20.70
4343	4.03	4	.....	.....	....	.....	.....	19.13	16	26.27	.....
4345	4.27	3½	.....	.....	.....	.....	.....	22.78	23	29.56	.....
4337	1.38	1¼	2.46	2¼	1.27	10.47	10	11.74	11½	17.58	16.60
4354	1.36	1	2.52	2¼	1.45	10.32	9	11.77	10	17.50	14.65
4338	.....	.....	.....	.....	1.66	14.88	14	16.54	.....	10.42	9.80
4366	2.18	2	2.17	2	1.61	11.21	8	12.82	10	20.56	16.80
4351	3.49	2.85	3.48	2¼	1.02	9.03	10	10.05	11½	23.39	21.40
4336	.89	½	1.42	1	1.43	7.48	7	8.91	8	12.14	9.90
4399	.....	.....	...	.....	2.61	11.87	14	14.48	15	8.31	9.80
4400	2.17	2	2.31	2	5.31	7.36	5	12.67	12	18.30	15.40
4398	1.18	1	2.22	2	2.68	9.46	9	12.14	10	16.29	14.40
4487	.....	.....	....	.....	2.28	12.73	14	15.01	15	8.91	9.80

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4034	G. R. Mowell, Glencoe Md.	Standard Bone Phosphate.	Glencoe.....
4488	" " "	Standard Bone Phosphate.	Glencoe.....
4503	Nickerson Fertilizer Co., Easton, Md	Special Mixture.....	Easton.....
4375	G. Ober & Sons Co., Baltimore, Md.	Dissolved Bone Phosphate.	Hampstead.....
4394	" " "	Dissolved Bone Phosphate and Potash.	Union Bridge.....
4389	" " "	Farmer's Mixture.....	New Windsor.....
4477	" " "	Farmer's Standard Ammoniated Phosphate.	Baltimore.. .....
4434	" " "	J. H. Gassaway's Ammoniated Dis. Bone.	Germantown.....
4459	" " "	Linthicum's Special Mixture.	Ellicott City.....
4492	Patapsco Guano Co., Baltimore, Md.	Baltimore Soluble Phosphate.	Cockeysville.....
4489	" " "	Coon Brand Guano.....	Cockeysville.....
4491	" " "	Grain & Grass Producer.	Cockeysville.....
4346	" " "	Pure Dissolved S. C. Bone.	Baltimore.....
4490	" " "	Special Wheat Compound—Ani. Bone Base.	Cockeysville.....
4362	J. Douglas Perkins, Coatsville, Pa.	Monarch H G. Pure Bone and Potash.	Baltimore.....
*4499	Piedmont-Mt. Airy Guano Co., Baltimore, Md.	Caroline Mixture for all Crops.	Greensboro.....
4350	" " "	Mt. Airy S. C. Bone Phosphate.	Baltimore.....
4422	" " "	Piedmont Dissolved Animal Bone.	Baltimore. ... ...
4423	" " "	Piedmont Dis. Bone Phosphate Potash Goods.	Baltimore.....
4476	" " "	Piedmont Guano for Wheat.	Baltimore.....
4421	" " "	Piedmont No. 1 Raw Bone Meal.	Baltimore.....
4419	" " "	Piedmont Pure Raw Bone Mixture.	Baltimore.....

*In Bulletin No. 49 the "comparative value found" was given as $14.59, when it should have been $16.59 with the schedule of valuations then in use. The "comparative value guaranteed" was $15.20.

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4034	2.01	2	2.35	2	3 24	11.01	10	14.25	11	$20.67	$18.40
4488	1.82	2	2.23	2	2.65	9.86	10	12.51	11	18.61	18.40
4503	.68	½	2.45	3	1.93	8.41	9	10.34	10	13.67	13.90
4375	.....	.....	.....	.....	.89	15.76	14	16.65	16	11.03	9.80
4394	.....	.....	2.48	2	.50	12.66	11	13.16	13½	11.44	10.20
4389	1.51	1	2.04	2	1.22	11.53	9	12.75	11	18.59	14.80
4477	2.39	2	2.56	2	3 29	8.58	8	11.87	10½	19.63	17.00
4434	2.84	2½	3.28	3	1.80	10.14	9	11.94	11	22.66	20.30
4459	1.56	1	2.12	2	.99	11.15	9	12.14	10½	18.35	14.60
4492	....	.....	1.89	2	.95	11.54	11	12.49	12	10.16	9.90
4489	1.12	1	3.09	3	1 36	9.27	9	10.63	10	16.26	15.40
4491	1.33	1¼	2.36	2	.99	10.58	10	11.57	12	17.33	16.55
4346	....	.....	.....	.....	1.05	14.43	14	15.48	15	10.10	9.80
4490	2.39	2½	2.60	2½	2.70	10.90	9	13.60	14	21.75	21.00
4362	1.01	1	5.43	7	1.31	10.82	10	12.13	.....	19.80	20.00
4499	1.04	1	2.02	2	1.40	8.17	8	9.57	9	13.87	13.40
4350	.....	.....	.....	.....	1.55	14.47	13	16.02	14	10.13	9.10
4422	2.76	2½	.....	.....	2.80	10.88	11	13.68	15	20.28	20.10
4423	.....	.....	.33	1	1.39	11.35	10½	12.74	11½	8.64	8 55
4476	2.11	2	1.45	1	1.99	8.61	8	10.60	10	17.19	15.80
4421	4.12	3½	.....	.....	.....	.....	.....	17.23	18¼	24.27	.....
4419	1.61	1	1.15	1	3.32	8.57	7	11.89	11	15.88	12.60

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4373	Piedmont-Mt Airy Guano Co., Baltimore, Md.	Piedmont Royal Ammon. Bone and Potash.	Baltimore.....
3612	W. A. Pleasants, Baltimore, Md.	Dorsey's Tobacco Fertilizer.	Baltimore.....
4482	" " "	H. G. Wheat Fertilizer.	Baltimore.....
4472	" " "	Wheat Food.....	Baltimore.....
4367	R. H. Pollock, Baltimore, Md.	Ammoniated Bone Phosphate.	Baltimore.....
4370	" " "	Dissolved S. C. Bone....	Baltimore.....
4481	" " "	Soft Ground Bone.....	Baltimore.....
4347	" " "	Special Wheat Grower..	Baltimore.....
4348	" " "	Victor Bone Phosphate..	Baltimore.....
4516	F. E. Postley, Smyrna, Del,	Dissolved S. C. Rock. ..	Greensboro .....
4517	" " "	L. & P. Phosphate.....	Greensboro.....
4493	Powell Fert. and Chemical Co., Baltimore, Md.	Red Bag.....	Baltimore.....
4436	Ramsburg Fertilizer Co., Frederick, Md.	Alkaline Phospho-Potassium.	Germantown.....
4040	" " "	Bone and Potash.....	Plane No. 4.....
4426	" " "	Dissolved Animal Bone.	Silver Springs.....
4427	" " "	Dissolved Bone Super Phosphate.	Silver Springs.....
3624	" " "	Dissolved Bone Super Phosphate.	Kemptown..... .
4435	" " "	Excelsior Half and Half	Germantown.....
4437	" " "	Excelsior Plant Food....	Germantown.....
4443	" " "	Old Virginia Compound.	Middletown.... ....
4428	" " "	Pure Bone Meal.....	Silver Springs.....
4453	Rasin Fertilizer Co., Baltimore, Md.	Acid Phosphate.....	Hood's Mills.....
4495	" " "	Ammoniated Super Phosphate.	Millington ....

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4373	1.50	1.30	2.47	3	1 10	7.40	6	8.50	8	$14.81	$13.70
3612	5.58	.....	4.24	.....	5.31	6.64	.....	11.95	.....	29.74	.....
4482	2.06	2	4.08	4	1 38	8.69	8	10.07	.....	19.50	18.00
4472	1.04	1	1.85	2	1.54	7.77	8	9.31	.....	13.36	13 00
4367	2.19	2	2.02	2	1.35	9.38	10	10.73	11	18.51	18.40
4370	.....	.....	.....	.....	.55	15.82	14	16.37	16	11.07	9.80
4481	3.54	3	....	.....	8.90	7.68	.....	16.58	14	21.86	23.00
4347	1.06	1	2.33	2	1.50	10.54	9	12.04	10	16.65	14.40
4348	.....	...	1.19	1	.44	10.78	9	11.22	10	8.83	7.50
4516	....	....	.....	.....	.55	13.88	.....	14.43	....	9.72	.....
4517	1.17	1	1.15	1	1.46	8.28	7	9.74	.....	13.52	11.00
4493	1.50	2	1.25	2	2.40	9.54	8	11.94	10	16.25	16.80
4436	.92	30	1.51	2	3.06	11.08	10	14.14	.....	16.57	12.90
4040	....	.....	2.12	3	1.45	13.88	12	15.33	.....	12.14	11.40
4426	2.05	2	....	.....	5.99	12.92	10	18.91	13	21.47	17.20
4427	.....	.....	.....	.....	.99	14.73	14	15.72	16	10.31	9.80
3624	.....	.....	.....	.....	.60	18.94	14	19.54	.....	13.27	9.80
4435	1.44	1	1.37	1	3.56	11.18	10	14.74	12	18.29	14.80
4437	2.77	2	1.08	1	3.94	11.36	9	15.30	11	22.33	16.80
4443	1.78	1½	1.90	2.10	4 06	9.64	9.36	13.70	11.56	18.50	16.84
4428	2.98	3½	.....	.....	.....	.....	.....	28.08	23	33.82	.....
4453	.....	.....	.....	.....	.37	14.09	14	14.46	15	9.86	9.80
4495	1.00	1	1.25	2	1.11	11.02	8	12.13	9	15.71	13.40

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4478	Rasin Fertilizer Co., Baltimore, Md.	Bone and Potash Fertilizer.	Baltimore.....
4431	" " "	Dissolved Bone.....	Gaithersburg .....
4479	" " "	Empire Guano.....	Baltimore.....
4526	Henry Reckord Mfg. Co., Belair, Md.	Dissolved S. C. Bone...	Belair.....
4527	" " "	Fine Ground Bone.....	Belair.....
4425	" " "	Raw Bone.....	Baltimore.. .....
4349	" " "	Special Compound.....	Baltimore.....
4464	J. S. Reese & Co., Baltimore. Md.	Dissolved Phosphate of Lime.	Elkton.....
4448	Reindollar & Co., Taneytown, Md.	Fish Phosphate.....	Taneytown..... ....
4449	" " "	Special Mixture.....	Taneytown.....
4392	Rinehart & Clemson, Union Bridge, Md.	No. 2 Bone Phosphate...	Union Bridge.....
4393	" " "	No. 3 Bone Phosphate...	Union Bridge.....
4342	Isaac Robinson, Baltimore, Md.	H. G. Soluble Phosphate	Baltimore.... .....
4340	" " "	Peerless Phosphate	Baltimore.....
4424	" " "	Potashed Bone.....	Baltimore.....
4365	" " "	Pure Bone Meal.....	Baltimore.....
4480	" " "	Pure Dissolved Bone....	Baltimore.....
4344	" " "	Pure Dis. Raw Bone.....	Baltimore..... .....
4352	" " "	Pure Raw Bone.....	Baltimore.....
4339	" " "	Special Wheat and Grass Phosphate.	Baltimore.....
4341	" " "	Standard Dissolved Bone Phosphate.	Baltimore.....
4511	E. C. Ross, Seaford, Del..	H. G. Acid Phosphate...	Aireys.....
4505	" " "	H. G. Wheat Phosphate.	Princess Anne.....

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4478	.....	.....	1.29	1¼	2.70	12.00	12	14.70	13	$10.23	9.85
4431	2.58	2	.....	.....	3.04	10.54	10	13.58	12	19.50	16.80
4479	2.52	2.43	1.69	1½	2.86	8.84	8	11.70	10	19.23	17.59
4526	.....	.....	.....	.....	2.43	13.26	14	15.69	.....	9 28	9.80
4527	3.99	3	.....	.....	.....	.....	.....	25.34	25	31.64	.....
4425	4.82	5.29	....	.....	....	.....	.....	20.14	20.38	25.25	.....
4349	2.06	2.03	2.15	2.13	1.85	10.34	10.66	12.19	13.18	19.41	19.89
4464	.....	.....	.....	.....	.61	15.73	14	16.34	16	11.01	9.80
4448	2.35	2	2.44	2	.80	9.26	8	10.06	.....	19.07	16.00
4449	1.45	1	1.57	1	.80	9.18	7	9.98	....	15.42	11.00
4392	2.06	1.55	2.95	2½	2.27	8.97	8.27	11.24	.....	19.01	15.42
4393	1.59	.76	2.24	3.21	1 93	9.94	8.09	11.87	.....	17.72	13.58
4342	.....	.....	.....	.....	1.07	14.59	14	15.66	.....	10.21	9.80
4340	.56	½	1.54	1½	2.38	7.79	8	10.17	10	11.96	11.80
4424	.....	.....	1.76	2	2.40	10.36	10	12.76	12	9.49	9.40
4365	4.89	4	.....	.....	....	.....	.....	22.32	20	28.18	.....
4480	2.62	2½	.....	.....	3.55	9.63	11	13.18	14	18.91	19.70
4344	2.64	2½	.....	.....	5.70	9.58	11	15.28	14	19.78	19.70
4352	4.66	4	....	.....	.....	....	.....	22.86	23	28.74	.....
4339	2.11	2	2.34	2	1.65	8.11	8½	9.76	11	17.44	17.50
4341	1.02	1	2.03	2	1.20	10.18	10	11.38	11½	15.75	15.60
4511	.....	.....	.....	.....	3.73	11.62	13	15.35	.....	8.13	9.10
4505	.93	2	1.20	2	4.67	9.70	10	14.37	.....	15.56	18.00

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling
4504	E. C. Ross, Seaford, Del.	Soluble Bone Phosphate, or Rock and Potash.	Princess Anne
4384	Charles Schaeffer, Westminster, Md.	Big Gun	Westminster
4388	" " "	Dissolved S. C. Bone	Westminster
4386	" " "	Governor	Westminster
4387	" " "	Leader	Westminster
4385	" " "	Pure Raw Bone Meal	Westminster
4383	" " "	Super "A"	Westminster
4522	Scott Fertilizer Co., Elkton, Md.	Elk Head Phosphate	Rising Sun
4471	" " "	Pure Dissolved Bone	Elkton
4531	" " "	Pure Ground Bone	Aberdeen
4523	" " "	Sure Growth Super Phosphate.	Rising Sun
4467	" " "	Tip Top Soluble Bone	Elkton
4524	" " "	Tip Top Soluble Bone and Potash.	Rising Sun
4532	Sharpless & Carpenter, Philadelphia, Pa.	Dissolved Bone Phosphate.	Aberdeen
4530	" " "	No. 1 Bone Phosphate	Aberdeen
4420	D. A. Sharretts, York Road, Md.	Ammoniated Super Phosphate.	Baltimore
4485	G. W. Sharretts & Co., Baltimore, Md.	Ammoniated Bone	Baltimore
4486	" " "	Fish Rock and Potash	Baltimore
4414	J. D. Simmons, Hagerstown, Md.	Wheat and Clover Producer Animal Bone	Hagerstown
4483	Slingluff & Co., Baltimore, Md.	Agencey Favorite H. O. D.	Baltimore
4457	" " "	Alkaline Super Phosphate.	Sykesville
4462	" " "	Ammoniated Bone	Ellicott City
4455	" " "	Ammoniated Super Phosphate.	Sykesville

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4504	....	.....	1.08	1½	2.29	11.15	10	13.44	11	$ 9.35	$ 8.70
4384	1.84	2	2.08	2	1.16	10.88	10	12.04	.....	18.94	18.00
4388	.....	...	.....	.....	.92	15.48	14	16.40	15	10.84	9.80
4386	1.57	1½	2.52	2½	.73	9.96	9	10.69	... .	17.48	16.00
4387	1.20	1	1.81	1½	1.43	8.95	8	10.38	.....	14.93	12.50
4385	4.83	4	.....	.....	....	....	.....	22.35	22	28.41	.....
4383	.85	¾	1.35	1	1.16	8.25	7½	9 41	8½	12.61	11.15
4522	1.20	1	1.15	1	1.33	10.74	8	12.07	10	16.02	12 80
4471	2.51	2½	.....	.....	3.26	13.95	13	17.21	15	22.78	21.30
4531	5.06	4	.....	.....	.....	.....	.....	23.46	22	27.28	.....
4523	2.51	2	2.10	2	2.84	10.32	9	13.16	11	21.09	17.80
4467	....	.....	....	.....	.79	15.09	14	15.88	.....	10.56	9 80
4524	.....	.....	1.81	2	1.73	12.67	11	14.40	.....	11.03	9.70
4532	2.76	3	4.61	5	3.66	9.36	8	13.02	.....	23.83	22.00
4530	2.38	2½	2.05	2	2.01	9.05	8½	11.06	.....	19.04	18.00
4420	1.30	1	1.30	1	.90	11.09	9	11.99	.....	16.65	13.00
4485	.65	½	1.23	1	1.03	5.28	5	6.31	6	8.87	7.90
4486	.34	½	1.04	½	.85	4.87	5	5.72	6	7.31	6.65
4414	1.48	2	6.79	6	5.70	10.56	12	16.26	.....	24.23	24.00
4483	2.88	.....	2.17	.....	3.54	11.50	.....	15.04	.....	23.73	.....
4457	.....	.....	1.76	4	.63	10.61	10	11.24	.....	9.32	11.00
4462	2.52	2½	2.21	2½	2.04	10.45	9	12.49	.....	21.04	19.00
4455	1.57	1	1.87	1	2.01	11.13	8	13.14	.....	18.51	12.20

Table of Analysis and Valuation of Fertilizers Made at the

No	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4417	Slingluff & Co., Baltimore, Md.	Baltimore Dissolved Bone.	Baltimore
4500	" " "	Bone and Potash	Dover Bridge
4052	" " "	South Carolina & Potash	Easton
4418	" " "	Dissolved S. C. Bone	Baltimore
4463	" " "	Half and Half	Ellicott City
4456	" " "	Pure Raw Bone, Dissolved.	Sykesville
4416	" " "	Special Bone Phosphate	Baltimore
4433	" " "	Universal Guano	Gaithersburg
4396	G. W. Stockdale, Thurmont, Md.	Ammoniated SuperPhos phate.	Thurmont
4395	" " "	Dissolved Animal Bone Phosphate.	Thurmont
4407	J. W. Stonebraker & Son Hagerstown, Md.	Bone Meal	Hagerstown
4403	" " "	Dissolved Animal Bone.	Hagerstown
4404	" " "	Dissolved Bone Phosphate.	Hagerstown
4406	" " "	Special	Hagerstown
4405	" " "	Standard Dissolved Bone	Hagerstown
4391	J. A. Stouffer, New Windsor, Md.	Butcher House Phosphate.	New Windsor
4390	" " "	Wheat Grower	New Windsor
4353	Wm. H. Streett & Co., Baltimore, Md.	Ammoniated Dissolved Bone.	Baltimore
3619	" " "	Ammoniated Dissolved Bone.	Glencoe
4358	" " "	Ground Bone	Baltimore
3623	" " "	Ground Bone	Shane
4364	" " "	S. C. Bone	Baltimore
4451	J. W. Sullivan, Monrovia, Md.	Sullivan's Sure Success.	Monrovia

Maryland Agricultural College, August, 1897, to February, 1898, continued.

No	NITROGEN Calculated as AMMONIA.		POTASH. K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4417	.95	1	.44	1	2.14	12.03	10	14.17	.....	$16.17	$14.00
4500	.....	.....	1.65	2	.67	11.30	10	11.97	11	9.69	9.20
4052	....	.....	1.77	.....	.70	11.47	.....	12.17	.....	9.93	.....
4418	.....	.....	.....	.....	.80	15.89	14	16.69	.....	11.12	9.80
4463	2.01	1¾	.....	.....	9.44	8.52	8	18.46	.....	18.51	13.25
4456	2.73	2½	.....	.....	2.15	13.48	11	15.60	14	22.50	19.70
4416	1.15	1	.....	.....	1.35	13.15	12	14.50	13	17.14	15.40
4433	1.19	1	1.73	2	1.48	11.00	9	12.48	.....	16.89	14.00
4396	1.05	1	2.71	2½	1.66	9.36	9	11.02	.....	15.88	14 50
4395	1.31	1½	2.64	2¼	1.80	9.07	8	10.87	.....	16.36	14.75
4407	4.88	4½	.....	.....	.....	.....	.....	20.35	21	29.26	.....
4403	2.58	2½	....	.....	3.04	13.30	12	16.34	.....	22.25	19.50
4404	1.05	1	2.26	2	1.31	9.29	10	10.60	13	15.22	16.20
4406	2.34	2½	4.04	4	3.53	10.50	9	14.03	13½	22.97	22.30
4405	3.10	2	.....	.....	10.39	8.52	10	18.91	14	21.98	17.60
4391	.99	¾	3.91	3	1.48	9.26	8	10.74	9	16.73	13.15
4390	.70	¾	2.54	2½	1.34	10.12	7½	11.46	9½	15.30	13.05
4353	1.66	1½	2.29	2	1.65	9.89	9	11.54	10	17.82	15.90
3619	2.06	½	2.33	2	1.70	9.95	9	11.65	.....	19.04	13.50
4358	4.73	4	.....	.....	.....	.....	.....	22.42	17	31.87	.....
3623	5.04	4	....	.....	.....	.....	.....	23.14	17	32.22	.....
4364	.....	... ...	....	.....	1.40	14.86	14	16.26	16	10.40	9.80
4451	1.82	2	2.07	2	3.55	10.63	10	14.18	.....	19.58	18.00

Table of Analysis and Valuation of Fertilizers Made at the

No	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4454	Susquehanna Fertilizing Co., Baltimore, Md.	Ammoniated Bone Phosphate.	Hood's Mills
4378	" " "	Alkaline Bone Phosphate.	Hampstead
4496	" " "	Crop Grower	Chestertown
4355	" " "	Pure Bone Phosphate	Baltimore
4452	" " "	Superior Rock Phosphate	Mt. Airy
4050	" " "	Superior Rock Phosphate	Crumpton
4438	" " "	XXV Phosphate	Germantown
4430	R. B. Tenney, Georgetown, D. C.	Pure Ground Bone Dust.	Gaithersburg
4411	D. A. Thomas, Hagerstown, Md.	Bone Mixture	Hagerstown
4408	" " "	Dissolved Bone	Hagerstown
4409	" " "	Farmer's Mixture	Hagerstown
4410	" " "	Fine Raw Bone	Hagerstown
4412	" " "	S. C. Bone	Hagerstown
4497	I. P. Thomas & Son Co., Philadelphia, Pa.	Normal Bone Phosphate.	Price's Station
4415	" " "	S. C. Phosphate	Hancock
4507	W. B. Tilghman Co., Salisbury, Md.	Bone and Tankage Mixture for Wheat & Grass	Salisbury
4509	" " "	Fish Mixture	Salisbury
4508	" " "	Mixture "B"	Salisbury
4506	E. S. Truitt, Salisbury, Md.	Fish Mixture XX	Salisbury
4498	J. E. Tygert Co., Philadelphia, Pa.	Popular Phosphate	Greensboro
4439	J. Tyson & Sons, Frederick, Md.	Ammoniated Super Phosphate of Lime.	Barnesville
4441	" " "	Half and Half Super-Phosphate.	Frederick.
4048	" " "	Half and Half	Park Mills

Maryland Agricultural College, August, 1897, to February, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4454	2.38	2	2.18	2	2.91	10.47	9	13.38	11	$20.95	$17.80
4378	.....	.....	2.23	2	1.13	10.53	10	11.66	12	9.83	9.40
4496	1.17	1	1.12	1	3.55	8.25	8	11.80	10	14.30	12.80
4355	2.21	2	2.60	2	6.00	10.41	9	16.41	11	22.04	17.80
4452	.....	.....	.....	.....	1.07	14.98	14	16.05	15	10.49	9.80
4050	....	.....	.....	.....	.91	16.52	14	17.43	.....	11.55	9.80
4438	1.45	1½	1.22	1	1.43	9.60	8	11.03	10	15.74	13.55
4430	4.74	.....	....	.....	...	.....	.....	19.75	.....	24.11	.....
4411	2.31	2	3.26	2	1.99	9.74	10	11.73	.....	20.73	18.00
4408	3.63	3	.....	.....	3.75	14.94	11	18.69	15	27.33	21.60
4409	1.55	1½	1.86	1½	1.93	9.12	8	11.05	.....	16.40	14.00
4410	4.53	4	.....	.....	.....	.....	.....	22.95	20½	31.35	.....
4412	.....	.....	.....	.....	.87	15.39	14	16.26	.....	10.77	9.80
4497	.91	1½	3.32	1½	2.63	8.40	8½	11.03	9½	15.50	14 15
4415	.....	.....	.....	.....	.44	16.62	14	17.06	16	11.63	9.80
4507	3.07	3	2.21	1	2.85	8.64	8	11.49	.....	21.20	18.00
4509	3.29	3½	1.21	1	1.84	8.52	6	10.36	.....	20.34	17.50
4508	3.98	3½	1.45	2	2.86	7.69	8	10.55	.....	22.22	20.50
4506	2.81	3	2.08	2	1.45	8.39	8	9.84	10	19.48	19.80
4498	1.01	1	1.25	1	1.51	6.93	7	8.44	8	11.81	11.60
4439	1.53	2	1.98	1	2.23	10.62	7	12.85	... .	18.08	14.00
4441	.81	½	.14	1	1.79	11.71	8	13.50	.....	14.86	10 50
4048	.88	2	.16	1	2.34	11.10	7	13.44	.....	14.84	14.00

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling
4049	J. Tyson & Son, Frederick, Md.	South Carolina	Park Mills
4442	" " "	Special Mixture	Frederick
4429	Virginia-Carolina Chemical Co., Richmond, Va.	Guaranteed 14% Acid Phosphate.	Rockville
4432	" " "	Guaranteed 13% Acid Phosphate.	Gaithersburg
4440	" " "	Special Compound for Wheat.	Walkersville
4377	Joshua Walker, Baltimore, Md.	Old Pittsburg Am. Bone Bone Super Phosphate.	Hampstead
4376	" " "	Victor Bone	Hampstead
4510	S L. Webster & Son Cambridge, Md.	Acidulated Bone	Secretary
4046	" " "	Acidulated Bone	Easton
4512	" " "	No. 2 Ammoniated Bone Phosphate.	Cambridge
4513	" " "	Poudrette Mixture	Cambridge
4514	" " "	The Times Bone Phosphate.	Cambridge
4465	M. E. Wheeler & Co, Rutland, Vt.	Electrical Dis. Bone	Elkton
4450	" " "	Royal Wheat Grower	Monrovia
4519	Williams & Clark Fertilizer Co., New York.	Acorn Brand Acid Phosphate.	Ridgely
4520	" " "	Americus Brand Pure Bone Meal.	Ridgely
4521	" " "	Dissolved Animal Bone	Ridgely
4518	" " "	Dissolved Bone and Potash.	Greensboro
4474	" " "	Special Wheat Grower.	Baltimore
4359	Robt. A. Wooldridge Co., Baltimore, Md.	Chieftain	Baltimore
4460	" " "	Bone and Potash Mixture.	Ellicott City
4361	" " "	Little Giant	Baltimore
4472	" " "	Pure Raw Bone	Baltimore

Maryland Agricultural College, August, 1897, to February, 1898, continued.

No.	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton, Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4049	.....	.....	.....	.....	2.12	15.06	14	17.18	.....	$10.54	$ 9.80
4442	1.02	1	.74	1	1.33	11.20	8	12.53	.....	15.53	12.00
4429	.....	.....	.....	.....	1.77	14.83	14	16.60	15	10.38	9.80
4432	.....	.....	.....	.....	1.82	13.62	12	15.44	13	9.53	8.40
4440	1.26	1	1.25	1	2 65	9.07	8	11.72	.....	15.16	12.00
4377	2.60	2.43	1.75	1½	3.04	8.62	8	11.66	10	19.38	17.59
4376	.....	.....	1.59	1½	1.37	11.33	12	12.70	13	9.79	10.10
4510	.....	.....	.....	.....	2.33	7.93	13.90	10.26	14.43	5.55	9.73
4046	.....	.....	.....	.....	.90	14.48	13.90	15.38	14.43	10.14	9.73
4512	2.04	2½	2.38	2	2.75	6.70	7	9.45	9.05	16.30	15.32
4513	.53	.51	2.16	3.01	1.2	5.63	6½	6.83	7.68	9.86	11.49
4514	.58	½	2.48	3	1.54	6.20	9	7.74	9.65	11.04	13.76
4465	....	.....	.....	.....	.63	15.68	13	16.31	15	10.98	9.10
4450	1.03	1	1.70	2	2.34	7.05	8	9.39	9	12.78	13.40
4519	.....	.....	.....	.....	2.46	14.54	13	17.00	14	10.18	9.10
4520	5.16	3	.....	.....	.....	.....	.....	18.25	20	27.95	.....
4521	2.59	2½	....	.....	3.31	11.17	10	14.48	.....	20.26	17.50
4518	.....	.....	2.02	2	3 81	10.01	10	13.82	11	9.79	9.20
4474	1.48	1	2.02	2	1.91	9.24	8	11.15	.....	16.46	13.00
4359	2.02	2	2.14	1½	1.95	10.18	9	12.13	10	19.16	16.90
4460	.....	.....	1.82	2	1.07	11.72	11	12.79	12	10.26	9.90
4361	1.01	1	2.59	·2	1.46	10.46	9	11.92	10	16.66	14.40
4473	4.59	4½	.....	.....	.....	....	.....	20.13	20½	26.87	.....

Table of Analysis and Valuation of Fertilizers Made at the

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Place of Sampling.
4461	Robt A Wooldridge Co., Baltimore, Md	Triumph Pure Bone Phosphate.	Ellicott City.....
4380	Zell Guano Co.. Baltimore, Md.	Calvert Guano.....	Westminster.....
4381	" " "	Dissolved Bone Phosphate.	Westminster.....
4379	" " "	Dissolved Bone Phos phate and Potash.	Westminster.....
4382	" " "	Economizer.....	Westminster.....
4051	" " "	Dissolved Bone Phosphate.	Crumpton.....

NOTE.—In Bulletin No. 49 the "comparative value found of Zell's Dissolved Bone Phosphate," sample No. 3913, was printed $10.08, when it should have been $15 08. The "comparative value guaranteed was $14 00. These values are calculated by the old schedule as used in Bulletin No. 49. By the present schedule they would be considerably lower.

Maryland Agricultural College, August, 1897, to January, 1898, continued.

No	NITROGEN Calculated as AMMONIA.		POTASH, K_2O.		PHOSPHORIC ACID.					Comparative Value per Ton Found.	Comparative Value per Ton Guaranteed.
					Insoluble Found.	Available.		Total.			
	Found.	Guaranteed.	Found.	Guaranteed.		Found.	Guaranteed.	Found.	Guaranteed.		
4461	1.54	1½	3.79	4	1.36	9.30	8	10.66	9	$18.25	$16 90
4380	1.00	¾	1.67	1½	2.40	10.11	9	12.51	11	15.74	13 55
4381	....	.....	.....	.....	1.71	14.79	14	16.50	16	10.35	9.80
4379	....	.....	.60	1	2.01	13.12	12	15.13	14	10.18	9.80
4382	1.19	1	1.19	1	1.35	11.05	9	12.40	11	16.35	13 80
4051	....	....	.....	.....	2 03	15.51	14	17.54	.....	10.85	9.80

Bulletin No. 52, February, 1898.

Table Showing the Mechanical Analysis of Ground Bone.

(The Chemical Analysis is Given in Preceding Table.)

No.	Name And Address of Manufacturer.	Name of Fertilizer.	Fine Less than 1-50 inch.	Fine-Medium, 1-25 to 1-50 inch.	Medium, 1-25 to 1-12 inch.	Coarse Larger than 1-12 inch.
4181	Alexandria Fertilizer and Chemical Co., Alexandria, Va.	Pure Raw Bone Meal	40	42	18	00
4107	Baugh & Sons Co., Baltimore, Md.	Bone Meal, Warranted Pure	46	35	19	00
4238	The Berg Co., Philadelphia, Pa.	Raw Bone Fine	28	30	29	13
4133	J. Bullock & Son, Baltimore, Md.	Pure Ground Raw Bone	41	26	33	00
4299	Chemical Co., of Canton, Baltimore, Md.	Baker's Standard Ground Bone	44	35	21	00
4239	E. A. Clendennin & Bro., Coloro, Md.	Fine Ground Bone	15	38	33	14
4291	" " " "	Pure Ground Bone	16	38	31	15
4124	Ed. L. Coulson, Baltimore, Md.	Pure Fine Ground Bone	45	21	34	00
4103	Detrick Fertilizer & Chemical Co., Baltimore, Md.	Pure Fine Ground Animal Bone.	40	37	23	00
4281	Eureka Fertilizer Co., Perryville, Md.	Bone Meal	62	27	11	00
4106	Griffith & Boyd, Baltimore, Md	Pure Fine Ground Bone Meal	23	20	57	00
4115	Griffith, Turner & Co., Baltimore, Md.	Strictly Pure Raw Bone Meal	30	20	50	00
4166	Hanover Bone Fertilizer Co., Hanover, Pa.	Pure Bone Meal	31	47	22	00
4249	S. M. Hess & Bro., Philadelphia, Pa.	Ground Bone	17	32	41	10
4100	J. Horner, Jr. & Co., Baltimore, Md.	Slaughter House Bone Dust	37	28	35	00
4221	Hubbard & Co., Baltimore, Md.	Warranted Pure Raw Bone	22	25	53	00
4213	Lazaretto Guano Co., Baltimore, Md.	Harford Bone	35	26	39	00
4235	" " " "	Pure Ground Bone	18	25	57	00
4187	Lister Agricultural Chemical Works, Newark, N. J.	Pure Raw Bone Meal	36	33	31	00
4173	Joseph Lister, Chicago, Ill.	Pure Bone Meal	45	39	16	00
4343	Miller Fertilizer Co., Baltimore, Md.	Ground Bone	50	24	26	00
4345	" " " "	Ground Bone	44	30	26	00
4421	Piedmont—Mt. Airy Guano Co., Baltimore, Md.	Piedmont No. 1 Raw Bone Meal	45	22	33	00
4428	Ramsburg Fertilizer Co., Frederick, Md.	Pure Bone Meal	68	26	6	00
4527	Henry Reckord Mfg. Co., Belair, Md,	Fine Ground Bone	50	31	15	4
4425	" " " "	Raw Bone	12	36	52	00
4365	Isaac Robinson, Baltimore, Md.	Pure Bone Meal	24	30	46	00
4352	Isaac Robinson, Baltimore, Md.	Pure Raw Bone	31	27	42	00
4385	Chas. Schaeffer, Westminster, Md.	Pure Raw Bone Meal	24	36	40	00
4531	Scott Fertilizer Co., Elkton, Md.	Pure Ground Bone	15	26	49	10
4407	J. W. Stonebraker, Hagerstown, Md.	Bone Meal	46	29	25	00

Table Showing Mechanical Analysis of Ground Bone—Continued.

No.	Name and Address of Manufacturer.	Name of Fertilizer.	Fine Less than 1-50 inch.	Fine-Medium 1-25 to 1-50 inch.	Medium 1-25 to 1-12 inch.	Coarse Larger than 1-12 inch.
4358	W. H. Street & Co., Baltimore, Md.	Ground Bone.....	53	25	17	00
3623	" " "	Ground Bone.....	46	36	18	00
4430	R. B. Tenney, Georgetown. D.C.	Pure Ground Bone Dust.....	11	27	62	00
4410	D. A. Thomas, Hagerstown, Md.	Fine Raw Bone.....	48	37	15	00
4520	Williams & Clark Fertilizer Co., New York.	Americus Brand Pure Bone Meal.....	41	35	24	00
4473	Robert A. Wooldridge Co., Baltimore, Md.	Pure Raw Bone.....	30	36	34	00

LIST OF FERTILIZERS LICENSED FOR SALE IN MARYLAND FOR THE YEAR ENDING FEBRUARY 1, 1898.

(Supplement to List Published in Bulletin No. 49, August, 1897.)

ALEXANDRIA FERTILIZER AND CHEMICAL COMPANY, ALEXANDRIA, VA.

Pure Raw Bone Meal.

BAUGH & SONS CO., BALTIMORE, MD.

Fish Phosphate.
Special Mixture.

B. A. BETTS, CHEWSVILLE, MD.

Jos. Lister's Fine Ground Bone.

A. D. BIRELY & SONS, LADIESBURG, MD.

No. 1 Ammoniated Bone Phosphate.
No. 2 Dissolved Bone.

JOHN BULLOCK & SON, BALTIMORE, MD.

Pure Ground Raw Bone.

HENRY COPE & CO., LINCOLN UNIVERSITY, PA

Ammoniated Bone Phosphate.
Potato and Corn Phosphate.

CROCKER FERTILIZER AND CHEMICAL CO., BUFFALO, N. Y.

High Grade Cereal Guano.

E. E. DE LASHMUTT, FREDERICK, MD.

Delashmutt's Mixture.

DETRICK FERTILIZER AND CHEMICAL CO., BALTIMORE, MD.

Alkaline Bone.
Carroll Mixture.
Emory's Bone and Potash.
Fish Mixture.
P. & B. Special Fertilizer.

J. W. DORSEY, ELLICOTT CITY, MD.

Dorsey's Mixture "D."

DRAPER, DAVIS & CO., MILFORD, DEL.

Jumbo Phosphate.
Rock.
XX Raw Bone Phosphate.

THOS. W. ELIASON, CHESTERTOWN, MD.

Chester Compound.
M. P.
No. 1 Compound.
Our Special.

FARMERS' FERTILIZER CO., WESTMINSTER, MD.

Pure Dissolved Bone.

GRIFFITH, TURNER & CO., BALTIMORE, MD.

Pure Raw Bone Meal.

HUBBARD & CO., BALTIMORE, MD.

Climax Super Phosphate.
Crescent Soluble Crop Producer.
Dissolved Raw Bone.
Warranted Pure Bone.

T. R. HUBBARD & CO., BALTIMORE, MD.

Special Mixture.

M. P. HUBBARD & CO., BALTIMORE, MD.

Celebrated Dissolved Bone Phosphate.
Farmers' Acme.
Farmers' Old Economy.

THOS. C. HUNTER, WHITE HALL, MD.

Ext. Ammoniated Bone Phosphate.

S. L. LAMBERD & CO., BALTIMORE, MD.

S. L. Lamberd & Co. Favorite.

A. A. LECHLIDER, HAGERSTOWN, MD.

Eagle Bone Phosphate.
Soluble Bone.
S. C. Bone.

LISTER'S AGRICULTURAL CHEMICAL WORKS, NEWARK, N. J.

Animal Bone and Potash.
Special Crop Producer.
Special for Wheat and Grass.
Special for Wheat.
Success Fertilizer.

W. A. McKENNEY, CENTREVILLE, MD.

Compound.
No. 1 D Wheat Fertilizer.
Soluble No. 3 Phosphate.

MONUMENTAL CHEMICAL COMPANY, BALTIMORE, MD.

Monumental Acid Phosphate.
Soluble Bone Phosphate and Potash.
Wm. Penn, Crop Grower.

MILLER FERTILIZER COMPANY, BALTIMORE, MD.

Special Wheat Grower.
Ground Bone.
W. G. Phosphate.

OBER & SONS, BALTIMORE, MD.

Hood's Special Mixture.
Gassaway's Ammoniated Dissolved Bone.
Linthicum's Special Mixture.
Sharrett's Standard Dissolved S. C. Rock Phosphate.
Valiant's Ammoniated Wheat Grower.

WM. A. PLEASANTS, BALTIMORE, MD.

H. G. Wheat.
Wheat Food.

PIEDMONT-MT. AIRY GUANO CO., BALTIMORE, MD.

Piedmont No. 1 Raw Bone Meal.
Piedmont Dissolved Animal Bone.

RAMSBURG FERTILIZER CO., BALTIMORE, MD.

Excelsior Half and Half.

ISAAC ROBINSON, BALTIMORE, MD.

Pure Dissolved Raw Bone.
Peerless Phosphate.
Special Wheat and Grass Phosphate.

SCOTT FERTILIZER CO., ELKTON, MD.

Elk Head Super Phosphate.

G. W. SHARRETTS & CO., BALTIMORE, MD.

Sharretts' Climax Fertilizer.

SLINGLUFF & CO., BALTIMORE, MD.

Bone and Potash.

J. W. STONEBRAKER & SON, HAGERSTOWN, MD.

Bone Meal.
Dissolved Animal Bone.
Dissolved Bone Phosphate.
Special.
Standard Dissolved Bone.

JOS. A. STOUFFER, NEW WINDSOR, MD.

Stouffer's Butcher House.
Stouffer's Soluble Wheat Grower.

D. A. THOMAS, HAGERSTOWN, MD.

Bone Mixture.
Dissolved Bone.
Farmers' Mixture.
Fine Raw Bone.
S. C. Bone.

J. E. TYGERT & CO., PHILADELPHIA, PA.

Popular Phosphate.

J. TYSON & SON, FREDERICK, MD.

Tyson's S. C.
Tyson's Special.

E. S. VALIANT & SONS, CHURCH HILL, MD.

High Grade Bone Phosphate.

ROBERT A. WOOLDRIDGE & CO., BALTIMORE, MD.

Pure Raw Bone.

LIST OF BRANDS OF FERTILIZERS LICENSED FOR SALE IN MARYLAND FOR THE YEAR ENDING FEBRUARY 1, 1899

(Corrected to February 18, 1898.)

BALTIMORE GUANO CO., BALTIMORE, MD.

Farmers' Dissolved Bone.
B. G. Ammoniated Bone Phosphate.

THE BERG CO., PHILADELPHIA, PA.

Berg's $25 Bone Manure.
Berg's Pure Raw Bone Fine.

JAS. BONDAY, Jr., & CO., BALTIMORE, MD.

Kainit.
Muriate of Potash.
Sulphate of Potash.

BRUMFIELD & FOSTER, COLORA, MD.

Hard Times Ammoniated Phosphate.

CHEMICAL COMPANY OF CANTON, BALTIMORE, MD.

Dissolved Animal Bone.
Soluble Bone and Potash.

CROCKER FERTILIZER AND CHEMICAL CO., BUFFALO, N. Y.

New Rival Ammoniated Super Phosphate.
Potato, Hop and Tobacco Phosphate.
Practical Ammoniated Super Phosphate.

RUFUS K. DAY, BROWNINGSVILLE, MD.

Ammoniated Bone Phosphate.

DETRICK FERTILIZER AND CHEMICAL CO., BALTIMORE, MD.

Ammoniated Bone Phosphate.
Corn Fertilizer.
Dissolved Bone.
Dissolved S. C. Bone.
Farmers' Friend.
Farmers' New Method Phosphate.
Fish Mixture.
Detrick Gold Eagle.
Imperial Compound.
Potato Fertilizer.
Pure Raw Bone.
Royal Crop Grower.
Sea Fowl Guano.
Soluble Bone Phosphate and Potash Fertilizer.
Special Mixture.
Standard Potato Fertilizer.
Vegetator Ammoniated Super Phosphate.
Wheat Fertilizer.

LOUIS F. DETRICK, BALTIMORE, MD.

Bone and Potash Mixture.
Kangaroo Komplete Kompound.
Sockless and Shoeless Fertilizer.
Orchilla Guano.
Silver Gray A. A. Phosphate.
XXtra Acid Phosphate.

DUDLEY & CARPENTER, BALTIMORE, MD.
California Tobacco Compound.
Dissolved S. C. Bone.
Soluble Bone Phosphate.
Special Tobacco Plant Guano.
Special Wheat Mixture.

DAVID ENGLAR, JR., MEDFORD, MD.
No. 3 Bone Phosphate.

ENGLAR & RINEHART, LINWOOD, MD.
Ammoniated Bone Phosphate No. 1.
Ammoniated Bone Phosphate No. 2.

FARMERS' FERTILIZER CO., WESTMINSTER, MD.
Acid Phosphate.
No. 1 Bone Phosphate.
No. 2 Bone Phosphate.
No. 3 Bone Phosphate.
XX Bone Phosphate.

W. S. FARMER & CO., BALTIMORE, MD.
B. & P. Phosphate.
Clyde.
Harvest Queen.
Standard.
Tobacco and Potato Guano.

N. I. GORSUCH & SON, WESTMINSTER, MD.
Westminster Dissolved Bone.
Westminster 3 XXXX.

GRIFFITH, TURNER & CO., BALTIMORE, MD.
Animal Bone Phosphate. Soft Ground Bone.
Ammo. Alka. Plant Food. High Grade Acid Phosphate.
Ammoniated Butchers' Bone Phosphate.
Dissolved Bone.

HANWAY & KEEN, BEL AIR, MD.
Special Mixture.
Standard High Grade Guano.

HANOVER BONE FERTILIZER CO., HANOVER ,PA.
Blood and Bone Compound.
Disolved Bone Phosphate.
Excelsior Combined.
Farmers' Crop Winner.
Pure Bone Meal.
S. C. Rock.

S. M. HESS & BRO., PHILADELPHIA, PA.

Ammoniated Bone Sup. Phosphate.
Ground Bone.
Keystone Bone Phosphate.
Potato and Truck Manure.
Soluble Bone and Potash Phosphate.
Special Compound.

JOSHUA HORNER, Jr., & CO., BALTIMORE, MD.

Ammoniated Raw Bone Sup. Phosphate.
Cultivator.
Dissolved Slaughter House Bone Dust.
Slaughter House Bone Dust.
Virga. Tobacco Sustain.

T. R. HUBBARD & SON, CHESTERTOWN, MD.

Imperial Compound.
Peerless Fertilizer.
Special Mixture.
Victor Phosphate.

M. P. HUBBARD, BALTIMORE, MD.

Ammo. Bone and Potash.
Harvest King.

S. L. LAMBERD, BALTIMORE, MD.

Boss.
Favorite.

LAZARETTO GUANO CO., BALTIMORE, MD.

Alkaline.
Ammo. Bone Phosphate.
Bone Compound.
Crop Grower.
Dissolved Animal Bone.
Early Trucker.
Forsythe and Linthicum Mixture.
Harford Bone.
Pure Dissolved S. C.
Pure Ground Animal Bone.
Retriever.
Spesial Tobacco and Potato.

J. H. LONGFELLOW, GREENSBORO, MD.

Wheat Grower.

MAPES FORMULA & PERUVIAN GUANO CO., NEW YORK.

Complete Manure, "A" Brand.
Potato Manure.
Vegetable Manure or Complete Manure for Light soils.

F. MAYNARD, BALTIMORE, MD.

High Grade Truckers' Pride.
High Grade Maynard's Choice.

MARYLAND FERTILIZER & MANUFACTURING CO., BALTIMORE, MD.

Alkaline Bone.
Ammo. Bone.
Bone and Super Phosphate.
Dissolved Animal Bone.
Dissolved Phosphate.
Dissolved S. C. Bone.
Fine Ground Animal Bone.
Globe Complete Manure.
Linden Super Phosphate.
O. K. Ammoniated Fertilizer.
Potato Food.
Sangston's Cereal and Plant Food.

GEO. W. MILLER, BALTIMORE, MD.

Miller's Mixture.
Miller's Wheat, Corn and Grain Grower.

MARYLAND GRANGE AGENCY, BALTIMORE, MD.

No. 2 Corn and Potato Fertilizer.
No. 1 Agency's Favorite.

F. MEHRING, BRUCEVILLE, MD.

Acid Phosphate.
Dissolved Raw Bone.
Emmerts' Half and Half.
General Crop Grower.
$26.00 Phosphate.

GEO. R. MOWELL, GLENCOE, MD.

Standard Bone Phosphate.
Pure Dissolved S. C. Rock.

J. B. NICHOLS, BALTIMORE, MD.

Farmers' Friend.

NORTH WESTERN FERTILIZER CO., CHICAGO, ILL.

Ammo. Dissolved Bone.
Prairie Phosphate.
Pure Ground Bone.

G. OBER & SONS, BALTIMORE, MD.

Ammo. Wheat and Grass Grower.
Avondale Ammoniated Dissolved Bone.
Dissolved Animal Bone.
Dissolved Bone.
Dissolved Bone Phosphate.
Dissolved Bone Phosphate and Potash.
Farmers' Mixture.
Farmers' Standard Ammoniated Phosphate.
Fish Bone and Potash Mixture.
Pure Bone Meal.
Special Ammo. Dissolved Bone.
Special Plant Food.
Special Compound for Tobacco.

PATAPSCO GUANO CO., BALTIMORE, MD.

Baltimore Soluble Phosphate.
Coon Brand Guano.
Dissolved Raw Bone.
Early Trucker.
Grain and Grass Producer.
Grange Mixture Dissolved Bone Phosphate.
Patapsco Tobacco Fertilizer.
Patapsco Ammoniated Corn Fertilizer.
Pure Ground Bone.
Pure Dissolved S. C. Bone.
Sea Gull Guano.
Special Wheat Compound.
Tobacco and Potato Fertilizer.

PIEDMONT MT. AIRY GUANO CO., BALTIMORE, MD.

Dissolved S. C. Bone.
Insula Guano for Corn and Oats.
Piedmont Potato Producer.
Piedmont Dissolved Bone Phosphate Potash Goods.
Piedmont Guano for Tobacco.
Piedmont Royal Ammoniated Bone and Potash.
Piedmont Raw Bone Mixture.

RASIN FERTILIZER CO., BALTIMORE, MD.

Ammoniated Alkaline Phosphate.
Ammoniated Super Phosphate.
Bone and Potash.

Dissolved S. C. or Acid Phosphate.
Empire Guano.
Ground Bone.
Rasin's Dissolved Bone.
Truck Guano.
Walker's Old Pittsburg Phosphate.
Walker's Economical Bone.
Walker's Dissolved Bone Phosphate.
Walker's S. C. Phosphate.
Walker's Victoria Bone.

W. E. ROBINSON, VALE, MD.

Tomato Grower.
Vegetable Fertilizer.

SHARPLESS & CARPENTER, PHILADELPHIA, PA.

No. 1 Bone Phosphate.
Dissolved Bone Phosphate.
Gilt Edge Potato and Tobacco Manure.

SLINGLUFF & CO., BALTIMORE, MD.

Ammoniated Bone.
Dissolved S. C. Bone.
McAfee's Potato Grower.
McAfee's Standard Ammoniated Bone.
Special Bone Phosphate.
Spinach Grower.
Tobacca Bed Fertilizer.
Top Dresser.
Truckers' Favorite.
Universal Guano.

SOUTHERN FERTILIZING CO., YORK, PA.

Ammo. Dissolved Bone.
Dissolved Bone Phosphate.
Export Bone and Potash.
Farmer's Choice Brand.
Gardeners' and Truckers' Delight.
General Crop Grower.
Pure Bone Meal.
Pure Ground Bone.
Special Potato Grower.

SUSQUEHANNA FERTILIZER CO., BALTIMORE, MD.

Alkaline Bone Phosphate.
Ammo. Bone Phosphate.
Crop Grower.
Potato Phosphate.

Pure Bone Phosphate.
Pure Ground Bone.
Superior Rock Phosphate.
Soluble Bone and Potash.
XXV Phosphate.

H. S. TAVEAU & CO., BALTIMORE, MD.

Allenton Guano.
Special Compound.
Special Compound No. 2.

W. B. TILGHMAN & CO., SALISBURY, MD.

Bone Tankage Mixture.
Fish Mixture.
Fish Mixture "B."

E. S. TRUITT, SALISBURY, MD.

Fish Mixture XX.

TYGERT-ALLEN FERTILIZING CO., PHILADELPHIA, PA.

Dissolved S. C. Rock.
Star Bone Phosphate.
Star Bone and Potash.
Standard Bone Phosphate.

M. E. WHEELER & CO., RUTLAND, VT.

High Grade Electrical Dissolved Bone.
High Grade Corn Fertilizer.
High Grade Grass and Oats.
High Grade Potato Manure.
High Grade Royal Wheat Grower.

WILLIAMS & CLARK FERTILIZER CO., NEW YORK.

Acorn Brand Acid Phosphate.
Royal Bone Phosphate.
Dissolved Bone and Potash.
Prolific Crop Producer.

F. M. WILSON & CO., POCOMOKE CITY, MD.

Favorite Truck Fertilizer.
Peninsula Ammoniated Super-Phosphate.

ROBT. A. WOOLDRIDGE & CO., BALTIMORE, MD.

Buffalo.
Chieftain.
Dissolved Bone.
Double Quick.

Florida Acid Phosphate.
Liberty Bell Potash Mixture.
Little Giant.
Special Potato.
Triumph.
Tuckahoe Bone.

ZELL GUANO CO., BALTIMORE, MD.

Ammoniated Bone Super-Phosphate.
Calvert's Guano.
Dissolved Bone Phosphate.
Dissolved Bone Phosphate Potash.
Economizer.
Pure Ground Raw Bone.
Special Compound for Potatoes and Vegetables.

Fertilizer Law of Maryland.

CHAPTER 397.

AN ACT to repeal sections one, two, three, four, five, six, seven, eight, nine, ten and eleven, of Article sixty-one, of Public General Laws, entitled "Manures and Fertilizers," as amended and re-enacted by Chapter three hundred and eighty-seven, Acts of 1890, and to re-enact the same with amendments.

SECTION 1. Be it enacted by the General Assembly of Maryland, That sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11, of Article 61, of the Code of Public General Laws, as amended and re-enacted by Chapter 387, of Acts of 1890, be and the same are hereby repealed and re-enacted to read as follows:

SECTION 1. That the term fertilizer, as used in this Act, shall be held to mean any commercial fertilizer, or any article, substance or mixture sold, offered or exposed for sale for manurial purposes within this State, of which the selling price shall be more than ten dollars per ton of two thousand pounds.

That the term brand, as used in this Act, shall be held to mean the name under which the commercial fertilizer is sold, together with the statement of the percentage of valuable ingredients contained therein.

That the professor in charge of the Chemical Department of the Maryland Agricultural College shall be *ex-officio* State Chemist, or (that the term State Chemist, as used in this act, shall mean the professor in charge of the Chemical Department of the Maryland Agricultural College.)

SEC. 2. And be it enacted, That before any fertilizer is sold, offered or exposed for sale within the State, the following conditions must be complied with: (1) The importer, manufacturer, manipulator, dealer or agent shall take out a license for the sale of fertilizer, which license shall be rated upon the number of brands contemplated to be sold at the rate of fifteen dollars for each brand; said license to be prepared and furnished by the Comptroller of the Treasury, and to be issued at any time, to be good until the first day of February following; provided, that when any such importer, manufacturer or manipulator shall have taken out a license as herein provided, it shall not be necessary for any other person, as his agent or representative, to take out a license to sell the fertilizers provided for by the party who has taken out such license. (2) Every bag, barrel or package of fertilizer, and every

parcel or lot, if sold in bulk, must bear in legible print, or be accompanied by a clear and true statement showing the net pounds of fertilizer in the package or lot, the name, brand or trade-mark under which the fertilizer is sold, the name and address of the importer, manufacturer or manipulator, the place of manufacture or manipulation, and a chemical analysis stating the per centum of the minimum, and only the minimum, contained therein of nitrogen or its equivalent in available ammonia, of potash soluble in distilled water, and of available phosphoric acid.

SEC. 3. And be it enacted, That any failure to comply with any or all of the conditions provided in section two of this Act, shall be punishable by a fine of one hundred dollars ($100) for the first offence, and of two hundred dollars ($200) for every subsequent offence.

SEC. 4. And be it enacted, That any person, firm or company selling or offering for sale any fertilizer in this State, or intending so to do, and not licensed by the Comptroller as provided by this Act, shall on and before the thirty-first day of July in each and every year, send his or their name or names with the postoffice address and the names of the kinds, brands and trade-marks, and of the manufacturer, importer or manipulator of each fertilizer sold or proposed to be sold to the Maryland Agricultural College, and the same shall be registered in suitable books kept for that purpose, and any failure to comply with the provisions of this section, shall be punishable by a fine of twenty-five dollars ($25) for the first offense and of fifty dollars ($50) for every subsequent offense.

SEC. 5. And be it enacted, That it shall be duty of the Maryland Agricultural College to analyze without cost or charge, all samples of fertilizer sent to it for the purpose of being analyzed by any person or persons purchasing or procuring the same in this State for his or their use or uses; provided, such persons are not interested in the analysis desired other than a consumer, of which affidavit shall be made and shall accompany each sample or brand; and further, such samples are taken and sent as described by this Act and free of cost of transportation to said college, and it shall be the duty of the Maryland Agricultural College to procure samples as far as practicable in every year, of all the fertilizers sold and used in this State, for the purpose of analyzing the same, and any duly authorized agent or representative of the said college shall have the right to take samples as provided by the Act from any lot or parcel of fertilizer in transit or in possession or keeping of any manufacturer, manipulator, dealer or agent, and sold or offered for sale in this State, and it shall be the duty of the Maryland Agricultural College to send in the result of every sample of fertilizer to the persons from whom such sample was taken or received, and also to publish from time to time the results of the analysis made by the said college of the samples sent to or procured by it for such purpose, and it shall be the duty of the Maryland Agricultural College when reporting or publishing the result of any analysis made, to state the commercial value in dollars

and cents of the fertilizer so analyzed, per ton of two thousand pounds, such value to be based upon the analysis made by the college, and upon a standard of valuation to be ascertained, fixed and published by said college, annually, after conference with the proper officials of adjacent States.

SEC. 6. And be it enacted, That all samples of fertilizers for analysis at the Maryland Agricultural College shall be taken from unbroken packages that have not been injured in transit or by exposure, and when in the possession of purchasers within thirty days after coming into their possession, and every such sample when taken by an agent or representative of the college, shall be taken in the presence of the owner, agent or dealer in possession thereof, or of his or their representatives, and when by an owner or consumer, it shall be taken in the presence of one disinterested witness; and every sample shall be taken from a bag or package or a number of bags or packages, which shall not be less than five per cent. of the whole lot to which the sampling pertains; and in every case not over two pounds shall be taken from near the top, the bottom and the middle of the bag or packages sampled, and these portions shall be thoroughly mixed in a clean dry place, and a sutiable sample shall be taken from said mixture and placed in a suitable vessel or vessels carefully closed with identifying labels, both within and without the vessel or vessels, and the same then taken or sent by safe carriage to the said college for analysis; and there shall accompany every such sample a full and complete statement and description of the place and time of sampling, of the lot of fertilizer sampled, of all marks on the bags or packages thereof, and other facts relating to the same, and such statement and description shall be signed by the person who does the sampling and by the witness thereto.

SEC. 7. And be it enacted, That the funds received by the Comptroller from the licenses issued under this Act shall be paid into the Treasury and be set apart as a specific fund to pay the cost and expenses of conducting the analysis provided for in section five of this Act, and the Treasurer shall semi-annually pay over to the Maryland Agricultural College the money received from said licenses; provided, that the amount paid in any one year shall not be more than at the rate of fifteen dollars ($15) for each sample of fertilizer analyzed by the said College.

SEC. 8. And be it enacted, That any purchaser of fertilizer who shall be injured or defrauded by the contents of the bag, barrel or other packages, not conforming in quantity or quality to the marks, labels or statements on or accompanying the same, may recover from the seller or sellers thereof, in an action of debt, an amount equal to the purchase money of said fertilizer and the cost of suit; and in case the purchase is made of an agent of any person or persons residing out of the limits of the State of Maryland, or company or corporation whose principal place of business is out of the State, manufacturing, compounding, preparing

and furnishing for sale any such commerical fertilizer, the purchaser thereof may, at his or her option, proceed by attachment, as now provided for by law in cases of non-resident and absconding debtors, against any property, rights or credit of any person, persons, company or corporation selling, manufacturing, preparing, compounding or furnishing said fertilizer when such property, rights or credits can be found within the limits of the State of Maryland.

SEC. 9. And be it enacted, That any manufacturer, dealer, agent or other person or persons who shall adulterate, add to or to take anything from any fertilizer, sold or offered for sale within this State, or who shall use the brand or trade mark of any manufacturer or dealer other than his own, shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof in any Court having jurisdiction, be punished by a fine not exceeding two hundred dollars ($200) and imprisonment in jail not exceeding six months, or by fine and imprisonment at the discretion of the Court before whom he shall be tried.

SEC. 10. And be it enacted, That this Act shall not affect parties importing, manufacturing or manipulating fertilizer for their own use if not sold or disposed of; and it shall not apply to substances and materials sold in bulk to manufacturers or manipulators of fertilizer, and nothing in this Act shall prevent the buyer and seller from making contracts in reference to the price to be paid dependent upon the composition or quality of the fertilizer contracted for, but no arrangement or agreement, verbal or written, made by or between any seller and buyer of fertilizer in this State, for the purpose of exonerating the seller or manufacturer from liability for any violation of any of the provisions of this Act shall exempt any person from such liability.

SEC. 11. And be it enacted, That it shall be the duty of all State's Attorneys to prosecute all persons accused of violating this Act, or any of the provisions of this Act, or of the Act to which this is a supplement.

SEC. 12. And be it enacted, That this Act shall take effect on the first day of May, in the year eighteen hundred and ninety-four.

Approved April 6th, 1894.

FRANK BROWN,
Governor.
JAS. H. PRESTON,
Speaker of the House of Delegates.
JOHN WALTER SMITH,
President of the Senate.

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 53.

Special Investigation of the So-called "New" Horse Disease in Maryland.

COLLEGE PARK, MD.

MARCH, 1898.

MARYLAND

Agricultural Experiment Station.

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Located on the B. & O. R. R., 8 miles N. of Washington, D. C.

NOTICE.

The bulletins of the Station will be mailed free to any citizen of Maryland who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or any failure to receive the bulletins.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

R. H. Miller, Esq., Director,

Maryland Agricultural Experiment Station,

Sir:—

Pursuant to your instructions of the 30th ultimo, regarding co-operation with the State Veterinarian in the investigation of the malady existing among horses in the State at that time, I visited the several sections reported as being infested, and tender herewith my report of said investigation.

Respectfully yours,

College Park, Md.,

Samuel S. Buckley,

23rd October, 1897.

Veterinarian.

SPECIAL INVESTIGATION

OF THE SO-CALLED "NEW" HORSE DISEASE IN MARYLAND.

By Dr. Samuel S. Buckley.

Having been informed that the "new" horse disease was prevailing to a great extent in Worcester County, Maryland, I repaired immediately to Snow Hill, its County Seat. Upon my arrival I learned that the trouble had abated, and at that time no case was to be found. The following information I received from reliable sources:

First: That death resulted in nearly every instance.

Second: That horses at pasture were more often affected than those in the towns; but pasturage was not essential to its development, as a number of horses died that had not been grazing for two or three years.

Third: Affected horses rarely received treatment.

Fourth: The general opinion was that the young horses and colts were more susceptible to the disease. Old horses, however, contracted the disease and died of it.

Fifth: The ration usually fed in that section consisted almost exclusively of corn and corn fodder (the top fodder and blades). Pasturage as a rule was inferior.

Pocomoke City was next visited, where I could learn of but one case, which was eight miles away on the boundary line of Maryland and Virginia. In the country immediately surrounding Pocomoke, the disease had not been so severe as to occasion any alarm. Few cases had been reported. On account of the inaccessibility of this point, and the fact that I would have been delayed more than twenty-four hours, I failed to visit the above-mentioned case, and proceeded at once to Westover, Somerset County. This lies in the Fairmount District. Throughout this section the disease had been extremely prevalent, and fatal. The history of the disease here was simply a record of deaths. Up to the time of my arrival, there had been nineteen cases within a radius of three miles from Jamestown, and eighteen of these resulted fatally.

The cases seen by me here are given separately, as follows:

Case 1: Seen late on the evening of the 5th instant. The animal was taken sick on Saturday morning, and on Sunday got down. Remained in a semi-comatose condition up to the time I saw it, Tuesday evening. The body was very much emaciated, and the skin was knocked off the side of the head and legs, due to the movements of the animal after falling. The ears, nose and legs were cold, as was the entire surface temperature. Pulse very weak and respirations normal. The hind quarters were almost completely paralyzed. Had been growing weaker more rapidly during the last few hours. Early the next morning I was given permission to destroy him, which I did by opening the carotid artery and jugular vein. The blood from the vein was darker than normal and flowed sluggishly from both artery and vein, though the exit was unrestricted.

Post-mortem examination showed the stomach congested, and nearly filled with a foetid yellow fluid. It contained no solid matter. The intestines contained a similar fluid, and no solid matter, except at the rectum, which had a natural amount of faeces, normal in appearance, with the exception of a small amount of mucous covering the pellets. The bladder was distended with a large quantity of a pale yellow and syrupy urine. The kidneys were normal. The liver was paler than normal, and easily torn. The spleen was unaltered. The heart was normal, and the lungs so with the exception of the lobe on the side upon which the animal had lain. This was congested, but only slightly so. The meninges (brain coverings) had their blood vessels distended, though this was not so exaggerated as is found in some cases. One of the characteristics of this disease was pronounced, that of an extremely foetid condition of the nasal passages.

Case 2: October 6th. This was reported as being a case of the "new horse disease," but proved to be a case of spasmodic colic, which was treated and recovered. This is mentioned to show that very often cases are reported as having recovered spontaneously from this disease where the diagnosis has been wrong. In the same way deaths are often attributed to this disease which properly come under another category.

Case 3: October 6th. Diagnosed as the early stages of this disease. Ordered removal to a large shed, and dieting on bran mashes and timothy hay. Gave hypodermically one grain of sulphate of strychnine, and repeated three times a day. Applied cold water to the head every hour. Continued this treatment throughout for five days, and then gave a tonic of nux vomica and quinine. The symptoms became more alarming up to the middle of the third day, when a change set in and improvement continued until recovery was complete. The temperature was never higher than 102.6.

Case 4: October 8th. Diagnosed the disease in a little further advanced stage than case No. 3 when found. Temperature 102.2. Horse had been worked hard all day and seemed well until toward evening, when she appeared dull. Gave hypodermic injection of strychnine at 7:00 P. M., and left directions for applications of cold water to the head. Was unable to see her again until 11:00 A. M. of the next day. Found her leaning against the stable in the sun, where the heat was intense. Water had been applied but once during the morning. Temperature at that time was 104.2. The animal was very weak, and staggered when walking. Continued the administration of strychnine, but was unable to have the application of water continued. She died the next day during my absence in returning to the Experiment Station, and I was unable to hold a post-mortem.

Case 5: This case was taken on Sunday, October 10th, and had been given strychnine three times up to the time of my return on Monday. I had taken a set of slings with me, and placed him in these at once, as he was in imminent danger of falling from weakness. He had already fallen a couple of times, but had been able to regain his feet. The surface temperature at the poll of the head was only slightly elevated. The ears and nose were cold. Breath becoming foul. Appetite gone. Continued the strychnine and applications of water. October 12th, no apparent improvement. Breath more foul. Had taken neither food nor

water since becoming sick. Finding the heart in good condition I began the administration of aconite, and on the next day found patient looking brighter, though very weak. During the day he drank some water and ate a very little. I removed a quantity of faeces manually, and succeeded in causing a flow of urine. This was the first discharge of either in three days. The appetite gradually returned, and the excretions took place naturally. The breath became less offensive. He regained strength rapidly, and in a week's time thereafter recovery was complete.

The details of the symptoms, course of the disease, etc., have been reserved for special consideration.

Having assured myself that the disease is the same as that described by Professor Large, of Brooklyn, N. Y., under the name "Cerebro-spinal Meningitis," and retained by Doctor M. R. Trumbower, in "Diseases of the Horse," I will give a minute description under the same title from the cases observed with recommendations for treatment, and the care to be exercised looking to its prevention.

CEREBRO-SPINAL MENINGITIS.

In the enzoötic form of this disease there is but slight variation in the symptoms in different individuals. While the character of the symptoms are nearly identical, they show a considerable variation in intensity.

Usually the first appearance of any abnormal condition is a lethargy or stupefaction; occasionally, however, excitement prevails. Other symptoms then follow in rapid succession. Brain disorder is clearly indicated from the first. Upon careful examination, we find a slight elevation of temperature at the poll of the head, which usually increases to a considerable degree. In some cases excessive heat at this point is absent. The tips of the ears are unnaturally cold. Apparent blindness may be present. The eyes are dull, and are rather more anaemic than congested. The nose and muzzle are cold. Upon examination of the mucous membranes of the nostrils, we find a bluish tinge. The breath rapidly becomes foetid, and later a muco-purulent discharge comes away. The mouth is cold and clammy. Shortly after the first symptoms are noticed, there is a severe grinding of the molar teeth. The pulse is normal at first, but becomes slightly accelerated. The neck is rigid; its tense muscles drawing it slightly to one side or backward. The heart is regular. The respirations normal and are but slightly altered throughout the attack. The muscles of the thigh and buttock often twitch. The temperature varies from normal to 104 degrees. The tail is limp, and unresisting, though its functions are not interfered with. The extremities are cold, though not so marked as the nose and ears. Weakness comes on rapidly. There may be simply a tendency to lean against objects and resting the feet of the opposite side, or a desire to walk to one side, giving to themselves a circular course. The appetite is lost or impaired. Often there is an inability to swallow solids or fluids, due to paralysis of the tongue and pharynx.

As the disease progresses we find all the symptoms aggravated. Muscular weakness increases, and the animal will stagger and fall. Being down they are seldom able to rise. While down and in a semi-comatose

condition they will toss their heads and continue the grating of their teeth as if suffering intensely. Salivation is noticed. Paroxysms come on at irregular intervals, followed by greater weakness than before. During these paroxysms the legs are moved incessantly as during locomotion. Complete coma may soon come on, and finally the animal dies.

If recovery is to occur, we will find a gradual increase in strength and return of the appetite. The offensiveness of the breath becomes less noticeable, and disappears entirely after two or three days. The excretions take place naturally, and at regular intervals. Recovery takes place about as rapidly as the symptoms have appeared.

POST-MORTEM APPEARANCES.

The rapidity and severity of the symptoms bear no definite relations to the extent of the lesions found. Frequently we find the cheeks of pharynx containing a mass of food. The stomach is slightly congested in some cases, and in others it is normal. The intestines are unchanged except that posteriorly the colon and rectum contain dry faeces. The liver is pale and friable. The spleen and pancreas are unchanged. The kidneys are natural in size and color. The bladder is often distended with a straw-yellow urine. The heart is unchanged, and the lungs usually so, though in cases which have been down for a considerable time there may be a slight congestion on the under side.

The meninges of the brain and spinal cord show evidences of a greater or less degree of congestion. The septum nasi (cartilage of the nose) is covered with an extremely foetid mucous. Its blood vessels are injected, giving to its surface a very dark coloration. The sinuses surrounding are more or less involved.

PROGNOSIS.

The probability of a recovery is very unfavorable in some cases, better in others, though in all cases the prognosis should be guarded. Those cases in which the symptoms appear gradually, are more favorable. The condition of the appetite is one of our best guides in the early stages of the disease for basing our prognosis.

TREATMENT.

On the first appearance of this disease upon a farm, a complete change should be made in the food. All mouldy grain or fodder should be rejected, and where possible, wheat bran should form part of the ration.

It is evident that in so severe and rapidly fatal a malady, powerful agents must be used. Proper nursing is necessary for success. Without it medicines avail but little. Placing the animal in slings early acts very beneficially in preserving their strength and increases the chances of recovery. When there is any considerable degree of heat at the poll of the head, we should resort to the constant application of cold water, crushed ice, or some cooling lotion (nitrate of potash and acetate of ammonium, each a teaspoonful to a gallon of water). In the early stages

these tend to check the flow of blood to the brain, and therefore reduce pressure upon it. Among medicinal agents we have recourse to ergot, aconite and belladonna. Nux vomica and strychnine seem to be capable of producing desirable actions. As all of these are extremely powerful and poisonous, they should be used where possible under the supervision of a veterinarian, so that their effects might be watched and their omissions ordered, if necessary. Maintaining the appetite with tempting foods and drink should be done. Purgatives and bleeding are to be avoided, as they seem to prove disastrous after the symptoms have become fully established. When the crisis has been passed and the animal begins to take nourishment tonics containing quinine and nux vomica should be given.

CAUSE AND PREVENTION.

Numerous theories have been advanced as to the probable cause of this disease, but up to this time experimentation has not been carried on sufficiently long to give us positive results. Its cause has been attributed to marshy lands, impure water, intense dry heat, to various plants and weeds, grain damaged by insects, and, in fact, to almost everything.

The Delaware Experiment Station has carried on several experiments with foods in the past few years with negative results.

A disease appearing in Kansas, very similar in nature, and described under the name "staggers," is said to be due to the fungus *Aspergillus glaucus*. However, experimentation will be necessary in order to ascertain whether this growth is responsible for our trouble.

In the report of 1891 of the Kansas Experiment Station, regarding the post-mortem lesions of this trouble, it speaks of an inflamed condition of the liver, and an abscess formation upon the brain. These lesions have not been found so far in the post-mortems of our diseased animals.

It is evident that owing to the severity of the disease, and its wide spread appearance among us, there should be carried on careful and thorough experiments in order to ascertain positively the cause, and allow us to intelligently direct means of prevention and treatment.

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 54.

Tomatoes.

COLLEGE PARK, MD.

MARCH, 1898.

MARYLAND

Agricultural Experiment Station.

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NOTICE.

The bulletins of the Station will be mailed free to any citizen of Maryland who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or any failure to receive the bulletins.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

Tomato Experiments.

SUMMARY OF RESULTS.

1.—The varieties giving the largest early yields are Early Ruby, Potato Leaf, Prize Taker, Autocrat and Canada Victor.

2.—The best varieties for main crop trucking are Paragon, Prize Taker, Perfection, World's Fair and Climax.

3.—The best varieties for the canning trade are Royal Red, Queen, Stone, Paragon, and Matchless.

4.—The best variety for late market or family use is the Buckeye State.

5.—The use of the Bordeaux Solution proved an effectual means of holding the tomato leaf blight in check.

6.—In 1896 spraying with Bordeaux Solution four times produced with 35 varieties, an average increase in yield of 2.5 tons per acre of marketable fruit.

7.—In 1897 spraying with Bordeaux Solution three times produced with 19 varieties an average increase in yield of 2.2 tons per acre of marketable fruit.

8.—Some varieties are more susceptible to the blight than others. In 1896 all but one variety, and in 1897 all but three varieties gave an increased crop of ripe fruit as a result of spraying with Bordeaux Solution, and all of the varieties showed an increase when the amount of green tomatoes at the end of the season are added.

9.—The increase in crop as a result of spraying, ranged from ½ of a ton to 6 tons in 1896, and from ½ to 4½ tons in 1897.

TOMATO EXPERIMENTS, 1896 and 1897.

By James S. Robinson.

The tests conducted with tomatoes during the seasons of 1896 and 1897, were confined to the two lines which were deemed of the most general interest to growers in this State, viz:

1st. Tests of varieties.

2nd. Tests of the use of the Bordeaux Solution for the tomato blight.

Tomatoes may be grown under a very wide range of conditions of soil and culture, which makes them of special interest to a very large class.

The tomato may well be considered a staple horticultural crop of this State, and to occupy the same relative position with the horticulturalist that corn does with the agriculturalist, provided all who grow tomatoes, can be properly classed in the horticultural ranks; yet it is doubtful if all tomato growers should rightfully be considered horticulturalists, from the fact that many grow this crop on the first attempt successfully, who would make a failure in almost every other branch of the business.

The tomato crop in this statement may be divided into three general classes.

1st. Tomatoes grown and ripened under glass for winter and early spring fancy trade.

2nd. Tomatoes started under glass, but grown on the early truck lands and sold for early and immediate consumption.

3rd. Tomatoes grown as a field crop and for the use of the canneries.

While all of these interests are fairly distinct as to the methods pursued in culture and the markets which they supply, yet they all have a common interest in the adaptability of varieties to their special needs, and have to combat with the same enemies in growing.

THE PLANT BED: An examination of the methods pursued and the conditions surrounding the seed bed and the early life of the plant has made it very evident to me that much of the trouble we now have with tomatoes can be attributed either directly or indirectly to that period in the early life of the plant before it is transplanted to the garden or field.

For early plants which are grown in the hot bed or cold frame, the common custom, is to sow the seed in February or early in March. With these provisions, no trouble would be experienced, if the weather conditions were always what is desired; but the rule is to have cold spells, with considerable cloudy and damp weather. During such times, it is necessary not only to keep the sash on the beds, but to have the whole covered with straw or some such material. This covering not only prevents all opportunity for proper ventilation, but excludes as well, the necessary

amount of light, which is always of great importance to the plant, and especially so at this stage of its life. This, together with the fact that the bottom heat which exists in a hot bed produces a favorable condition for root activity, causes an abnormal functional relation between the root and the foliage systems.

Again, even these unfavorable conditions are often aggravated by injudicious and untimely watering. In the above particulars, I believe may be found the primary cause for what is technically known as the oedema of the tomato.

In the case of growing plants, when the crop is to be used for the canning industry, the general practice is to sow the seed in the open border in April, and transplant direct from there to the field. An examination of a number of such plant beds during the season of 1897, showed without an exception, that the foliage of the plant was more or less injured by the flea beetle, and in some cases also by the Colorado potato beetle. This means starting operations with enfeebled plants, making them more susceptible to disease or insect ravages which they may be subjected to, and result in decreasing the crop.

The tobacco growers have found it necessary to cover their plants with hot bed cloth to protect them from insect injuries, and I am firmly of the opinion that the tomato grower will find greatly to his advantage to follow the same course. I made during the past season some tests of the use of this covering in growing tomato plants, and found it to work very satisfactory, and give much stronger and healthier plants, somewhat earlier, and entirely free from the evidence of insect ravages. Hot-bed cloth is comparatively inexpensive, costing one and one-half cents per yard. It comes one yard wide, and may conveniently be used singly or two breadths sewed together. A very good way to use it, is to set up six inch boards on edge, parallel to each other upon which to tack the cloth. These boards may be raised gradually to accommodate the growth of the plant or to permit the free circulation of air.

LAND USED FOR EXPERIMENTS: The land used for the variety and spraying experiments is quite uniform throughout. It is a heavy loam, with considerable admixture of gravel, being a portion of that devoted to the horticultural department, and lying in front (east) of the Station building. It has been used for growing a variety of vegetables during the past nine years, and has received during this time several coats of stable manure. The land used in 1896 was in tomatoes the year previous. A coat of stable manure was applied in the fall and plowed under. In preparing the land for planting, it was marked out with a plow 4x5 feet and at each intersection, where the plant was to be placed, there was a hill made by working into the soil an ordinary four pronged pitch fork full of well rotted manure.

The land used in 1897 was in melons the year previous and it received an application of commercial fertilizer just before planting.

FERTILIZER: The land previous to planting in tomatoes, was marked off in squares by drawing furrows 5½ feet each way and the commercial fertilizer sowed in the rows at the rate of 500 lbs. per acre. The fertilizer used was a home mixture, made up of the following ingredients in the proportions indicated:

Nitrate of soda	200 lbs.
Dissolved South Carolina Rock (14 per cent.)	1000 lbs.
Dried ground fish	500 lbs.
High grade sulphate of potash	300 lbs.
	2000 lbs.

(This would have approximately the following composition:

Phosphoric acid (P_2O_5)	9 per cent.
Nitrogen (calculated as ammonia)	4 per cent.
Potash (K_2O)	7½ per cent.

VARIETY TESTS.

In the variety tests, the aim has been to make them in such a way that the results would have an application wherever tomatoes are grown, yet we recognize the fact that the same varieties are not universally adapted to all soils and conditions, but yet, nearly enough so to make a general application of the results of about equal value throughout this State.

In making a selection of the varieties to be tested, the aim has been to get all those novelties and new varieties which would seem to have promise to be of interest for either forcing, trucking, or canning, and compare them with the standard and well recognized varieties for these several purposes. In making tests of forcing varieties, we have been at the disadvantage of not having at our command a green house, so that that portion of the work could not be carried out to the full extent, but had to stop with the preliminary portion of taking observations of habits and characters of growth and fruit, and making records of yields, etc.

SIZE OF PLOTS: In the tests made in 1896, the plots consisted of one row devoted to each variety and 20 plants to each row. The rows were five feet apart and the plants were four feet apart in the row of 400 square feet to each plot.

In the tests made in 1897 the plots consisted of one row devoted to each variety and 12 plants to each row. The rows were 5½ feet apart and the plants 5½ feet apart in the row or 363 square feet to each plot.

Time of sowing seed and transplanting: The seed for the test of 1896 was sown May 22nd, in the cold frame; transplanted to thumb pots June 4th, and set in the field June 15th. The seed for the test of 1897, was sown in the cold frame May 8th, and transplanted direct from the plant bed to the field June 18th.

The names of the varieties tested during 1896, are given in table 1, page 126, of those tested in 1897, in table 6, page 130. In these tables will also be found the total yield per picking and date of picking. From these tables the following are selected as the best five for use of the trucker, growing for the early market, as they begin to ripen earliest, and give the greatest amount of fruit during the first month of picking:

	Variety.	Color.	Habit of Growth on scale of 10.
1	Early Ruby.	Red.	7
2	Potato Leaf.	Purplish.	8
3	Prize Taker.	Purplish.	9
4	Autocrat.	Purplish.	9
5	Canada Victor.	Red.	8

The very earliest tomatoes are as a rule, irregular in shape, and will give way in price to the better varieties, as soon as these come on the market in quantity. The following are very early varieties, but are poor shaped and are not reliable yielders:

	Variety.	Color.	Growth on scale of 10.
1	Michigan Early.	Red.	10
2	Early Acme.	Red.	8
3	Advance.	Red.	7
4	Atlantic Prize.	Red.	7
5	Prize Winner.	Red.	8

The following varieties can be recommended to truckers, as they produce a good crop of smooth tomatoes, and if they should not have sale for them for immediate use, they are of a quality that can be disposed of to the canners to advantage. These varieties will also continue to bear well for a considerable period.

	Variety.	Color.	Habit of Growth on Scale of 10.
1	Paragon.	Red.	9
2	Prize Taker.	Purplish.	7
3	Perfection.	Red.	9
4	World's Fair.	Red.	8
5	Climax.	Purplish.	9

The canner desires tomatoes which are firm, smooth, of good color, ripen early and well up to the stem, and at the same time give a large yield. The five varieties possessing these requisites in the greatest degree are as follows, given in order of yield:

	Variety.	Color.	Habit of Growth on Scale of 10.
1	Royal Red.	Red	10
2	Queen.	Red	9
3	Stone.	Red.	9
4	Paragon.	Red	9
5	Matchless.	Red.	9

For a late market or family use, the Buckeye State is one of the best. It is a purplish tomato with a strong habit of growth, the fruit is very solid, and is less liable to crack than many of the other popular varieties.

Nos. 28, 29 and 30, which are omitted from table 1, crop of 1896, were respectively, the Purple Husk, Golden Husk and Golden Pear, and no records of the yield of these were kept, as none of them have any special commercial value, but may be regarded as varieties having interest only as indicating the variations in form and size in this crop. The only one of these that is found in the market is the Golden Pear and it finds but very limited sale. In general it may be said, that only a very few of the great number of new varieties that annually come to public notice, ever measure up to the claims made for them by their originators, or ever prove to possess enough value to make them worthy of general adoption by the commercial grower, and each test of this sort, only adds more evidence, to the effect that new varieties in any line, should be touched cautiously, and that the commercial grower should adopt for his

crop such varieties as are true and tried, and have been weighed in the balance and not found wanting.

THE TOMATO BLIGHT.

The tomato leaf blight, sometimes called simply "Tomato Blight" or "Southern Tomato Blight" has been so prevalent and disastrous to the tomato growers in every section of this State during the past two or three years, as to make it an object of special interest and inquiry. To meet this demand for information, the tomato blight has been made a special study for experimentation during the seasons of 1896 and 1897. The lines along which the research and tests have been conducted are about the same as has been suggested on several occasions by other investigators, yet in most cases, there has been nothing more than a suggestion made as to a course for the grower to adopt, and in no case, reported up to date, have the results been of that character which was convincing and satisfying to the ordinary grower. The first serious outbreak of this disease in this State, as far as I am aware, occurred about twenty years ago in the vicinity of Baltimore City. Since that time, other sections have been more or less involved and the severity of the trouble has been much more marked during some years than others, yet, never has it been so wide spread and prevalent, and affected the tomato industries of both trucker and canner as disastrously as it did the season of 1897.

The tomato leaf blight is a plant disease, caused by a bacterial germ, and may begin its attack when the plant is very young in the seed bed, or at any stage thereafter. It always begins by attacking the older or lower leaves first and gradually extends upwards. The appearance of the disease can first be recognized by the color of the leaf, which is slightly lighter, and also by a slight thickening and curling of the margin of the leaf. This is followed by the appearance of brown spots, which ultimately results in the leaf dying and dropping off. The effect of this loss of foliage, is an enfeebled condition and impairment of plant vitality, which causes a greater or less decrease in the quantity and quality of the crop, depending on the severity of the case. In some cases, with good cultivation, and conditions unfavorable to the development of the disease, the plant will outgrow the effects of the blight to a certain extent, yet even in such cases, there will be some deterioration in the quality of fruit through lack of shade, which will produce uneven ripening and sun scalding.

The tomato œdema is sometimes confounded with this blight, and in other cases, different condition is described, because of the existence of both œdema and blight on the same plant. The œdema shows on the younger and terminal foliage, while with the blight, the terminal foliage is always the most healthy. The œdema may often show on a few plants in the field, which will produce scarcely any fruit; whereas, with blight, the trouble is likely to be general.

Tomato blight may be contracted by the plant through a number of agencies.

1st. Through the use of seed from diseased and enfeebled stock.

2nd. Through the agency of the spores which may live over in the

soil of the seed bed or the field. The spores of this disease attacks many other plants besides tomatoes, especially, the potato, also some common weeds belonging to the same family of plants. Consequently great care should be taken not to follow in rotation plants which are subject to this disease, or to even plant them in closer proximity to one another than necessity enforces.

3rd. The infection may be produced through the agency of insect pests. To test this point more fully than ordinary observations made possible, I took some Colorado potato beetles that were feeding on potatoes that were blighted, and put them on some isolated and protected tomato vines, preserving others as checks. The result was as would be expected from the relationship of the plants: that the plants so inoculated were blighted, the checks not inoculated, showing no evidence of the disease.

Many other insects no doubt, can produce the same result, and notably so, the flea beetles, which feed in common on all of this family of plants. The Aphis which is so frequently found on tomatoes, and is sometimes thought to produce the condition caused by the blight, is, I believe in no sense, the cause of the disease, but only produces an enfeebled condition in the plant, which makes it more susceptible, and the progress of the disease more rapid.

EXPERIMENTS CONDUCTED: After some preliminary work and observations, which it is not necessary to give in detail in this connection, it was deemed most profitable to confine the work during the season of 1897 to the use of the Bordeaux spray after the plants were set in the field. For this purpose, and also to test if some varieties were more susceptible to the disease than others, the variety plots were divided into two parts, one-half was sprayed, the other half left untreated.

In 1896, the plants were sprayed four times on the following dates: On June 6th, while the plants were in the seed bed, and in the field on July 8th, 18th and 28th. The details as to pickings and yield per plot from the sprayed and unsprayed portions, with the 35 varieties used, are given in tables 1 and 2 on pages 126 and 127. The yields per acre, calculated in tons and bushels are given in table 3, page 128.

In 1897, the plants were sprayed three times, viz: July 14th, July 24th and August 6th. The details as to pickings and yield per plot from the sprayed and unsprayed portions, with the 19 varieties used this season, are given in tables 5 and 6, pages 130 and 131. The yield per acre, calculated in tons and bushels are given in table 7, page 132.

In tables 4 and 8, pages 129 and 133 are given the quantity of green tomatoes gathered at the end of the season from the sprayed and unsprayed sections for the years 1896 and 1897, respectively. These yields do not figure in the results given in tables 3 and 7, (which are of ripe and maketable crop), as green tomatoes do not have any commercial value, except to a limited extent by a few truckers. The quantity of green tomatoes is interesting, as given additional evidence of the value of spraying in holding up the crop.

A review of the results given in the tables, gives unmistakable evidence of the value of the use of the Bordeaux solution in growing tomatoes which are likely to be affected by blight. The spray was in no sense a

cure or even a complete preventive, yet, by its use, the disease was held in check to a great extent, so that the plant was able to carry on the functions of the developing and maturing of the fruit, so as to produce a marked increase in the crop, as shown in the tables. The average increase produced as a result of the spraying of the 35 varieties in 1896, was 2.5 tons per acre, and in 1897, with the 19 varieties tested, was 2.2 tons per acre.

By an examination of the figures given in the tables, it will be seen that some varieties were much more susceptible and gave way more to the ravages of the blight than others, but yet, in all cases, the spray proved effective in holding it in check. The increase of crop produced as a result of the spraying, ranged from $\frac{1}{4}$ ton to 6 tons per acre. In examining the above results, it must be kept in mind that the favorable results were obtained under what would be considered very unfavorable conditions, as the sprayed plants were in close proximity to the diseased plants, there being no separation whatever, but a continuation of the same rows.

CONCLUSIONS AND SUGGESTIONS.

From the results and observations of the work herewith reported together with general observations and the reports made upon the subject in agricultural literature, I believe it is safe to say that the Bordeaux Solution is valuable in holding this tomato leaf blight in check, but that it can in no sense be considered a remedy, or even a complete preventive. That the increase of crop will pay for the expense involved in making the applications, and that all truck growers in districts where this blight prevails, should adopt the precautionary measure of spraying with Bordeaux. Observation and experience has proven that the earlier the spraying is commenced, the more effective it is in checking the progress of the blight. In fact, I believe that the best place to begin the spraying is in the seed bed, and probably it would be a wise measure to spray the soil of the seed bed and also give the seed a slight spraying before it is sown.

It is evident that soil may be contaminated with the bacterial germ producing the blight, hence two crops of tomatoes should not be grown on the same land in succession, nor should tomatoes follow potatoes, or any class of plants, that are likely to be affected with the same blight. Also, it would be well to keep these different crops as widely separated each year as possible. It may be well to burn the refuse matter left on the field at the end of the season from all this class of crops, to prevent the spores from wintering over and being ready to attack the next year's crop.

DISTANCE APART FOR PLANTS: Conditions favorable for the development and spread of blight, will be found in warm dry spells of weather, and crowded conditions of plants, particular in the seed beds. In starting the seed bed, it will be advisable to sow the seed thinly in drills, six or eight inches apart, so as to insure a strong, stocky plant development. Distance apart for the plants in the field should be determined by the habit of growth of the variety selected and the strength of the land. 3 feet x 4 with some varieties, and under some circumstances is a better

distance at which to set the plants than 4 feet x 5 with other varieties and different surroundings. I think it a good point to make the rows wider one way than the other, for the reasons that a better opportunity would be afforded for spraying as well as gathering the crop, without injury to the plants, and it is sometimes desirable to continue the cultivation longer than close planting both ways would permit. It should be borne in mind, that the attention necessary to protect the plants in the seed beds is neither expensive nor laborious, that the theory of dealing with the blight is on the line of prevention and that the promise of best results is to start the crop with healthy plants, if possible.

BORDEAUX SOLUTION.

We make these suggestions for preparing the Bordeaux mixture for use in spraying tomatoes for the blight. 8 lbs. copper sulphate, 4 lbs. good, quick lime and 40-50 gallons water are the proportional materials. It is advised in the preparation, to have three wooden vessels so as to insure a complete, mechanical admixture of the ingredients. After putting in one of the vessels from 20-25 gallons of water, suspend in this the 8 lbs. of copper sulphate, it may be put in a bag of loose texture. This suspension is necessary in order to have a quick and complete solution. In another vessel, slack the lime with hot water, using water enough to slack it to a soft paste; add to this 20-25 gallons water, mix well, and strain to rid it of any impurities that might clog the spray nozzel. We wish now to thoroughly mix the lime water and copper solution, this can be done by pouring the contents of the two vessels simultaneously in the third, or by having two parties with a bucket each. When a combined spray is needed to protect the plants from insects as well as fungous troubles, add to the 40-50 gallons Bordeaux 4 oz. Paris Green. In applying the spray it is very important that the admixture is kept complete by agitation. Most spray pumps have devices for this.

TABLE I.—Results of Test of Varieties and Treatment for the Prevention of Tomato Blight.

YIELD OF PLOTS SPRAYED WITH BORDEAUX SOLUTION.

Size of Plots, 200 Square Feet, 1896.

Plot No.	Varieties.	DATE OF AND YIELD AT EACH PICKING.																			
		Aug. 18.		Aug. 22.		Aug. 26.		Aug. 29.		Sept. 7.		Sept. 16.		Sept. 19.		Sept. 24.		Oct. 2.		Oct. 16.		Total.	
		Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.
1	Liv. Favorite	.....		2	0	1	1	1	6	4	8	15	2	4	12	6	5	13	0	11	7	59	9
2	Golden Queen	0	10	1	5	1	6	2	1	3	15	16	11	4	3	5	12	20	3	8	0	64	2
3	Michigan Early	2	3	4	13	1	9	2	4	12	9	13	14	3	10	4	12	26	2	16	4	88	0
4	Trophy	0	13	0	8	3	2	0	6	5	10	37	12	3	15	4	7	27	0	16	2	100	2
5	Liberty Bell	.....		2	0	0	5	0	9	4	1	25	11	5	9	13	3	33	8	14	4	104	2
6	Atlantic Prize	.....		2	0	3	10	1	11	12	14	33	12	2	10	10	8	25	7	3	2	95	10
7	Royal Red	.....		1	7	1	10	.....		11	6	21	14	5	2	10	0	30	2	19	0	100	9
8	Ponderosa	.....		.....		1	14	1	2	2	7	23	1	2	9	3	11	13	3	9	0	56	15
9	Paragon	.....		2	13	5	1	1	0	10	0	31	14	4	4	11	10	28	2	16	9	111	5
10	Matchless	0	15	2	2	3	3	2	14	10	12	26	6	5	7	5	9	30	3	11	4	98	11
11	Early Acme	1	8	3	15	1	7	0	9	11	12	26	2	2	15	8	7	34	8	7	11	98	14
12	Advance	0	7	3	12	1	12	2	5	15	15	29	4	3	15	6	1	8	0	0	12	72	3
13	Democrat	0	8	2	2	0	14	0	13	6	13	15	5	3	9	2	15	23	0	9	3	65	2
14	Autocrat	.....		2	6	1	10	1	5	6	13	48	12	3	1	5	5	19	4	13	8	102	0
15	Canada Victor	1	6	4	10	4	7	2	13	20	6	28	11	5	0	10	15	21	0	3	13	103	1
16	Potato Leaf	2	0	4	3	2	13	3	6	16	14	44	7	2	6	7	9	17	1	4	14	105	9
17	Rose Peach	0	0	0	11	5	0	2	10	10	8	32	4	16	4	13	2	20	0	18	12	119	3
18	Purple Peach	.....		.....		0	12	0	11	5	7	15	12	11	13	8	12	14	12	15	8	73	7
19	Golden Ball	0	12	1	12	0	15	0	11	7	12	16	4	7	5	19	7	24	4	15	4	94	6
20	Cincinnati Purple	3	0	2	15	2	8	0	15	7	5	25	14	2	12	6	14	16	5	12	14	81	6
21	New Imperial	2	5	4	6	3	12	3	10	10	3	27	2	3	7	4	14	22	2	9	0	90	13
22	Early Ruby	6	8	11	3	15	7	8	10	27	12	13	14	1	8	2	15	6	14	1	15	96	10
23	Essex Hybrid	1	9	4	2	3	7	2	12	19	4	24	4	2	9	8	12	22	7	2	6	91	8
24	Acme	2	7	3	14	3	5	1	4	17	14	17	6	3	0	6	13	19	14	3	6	79	3
25	Beauty	2	5	5	13	2	12	1	10	13	8	19	12	2	6	3	11	14	13	6	0	72	10
26	Dwarf Aristocrat	0	9	0	11	1	8	0	7	4	4	16	5	1	10	2	8	8	3	0	15	37	0
27	Dwarf Champion	1	1	1	3	0	6	1	11	7	9	10	12	2	1	2	10	4	8	1	3	33	0
28	Purple Husk	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
29	Golden Husk	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
30	Golden Pear	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
31	Truckers' Favorite	.....		1	3	4	8	1	13	10	15	27	3	1	15	4	15	18	8	7	4	78	4
32	Ford Hook	3	9	4	14	2	8	3	13	22	4	17	14	1	15	4	4	9	9	2	2	72	12
33	Queen	1	6	1	6	3	6	2	14	12	4	23	11	3	1	6	8	17	0	10	0	81	8
34	Early Smooth	1	15	1	15	2	3	2	4	10	14	30	5	6	0	5	15	19	10	7	12	88	13
35	Prize Taker	4	12	7	13	1	14	2	1	21	2	27	9	2	9	4	14	16	14	10	8	100	0
36	Stone	.....		.....		1	15	2	14	12	0	31	6	4	13	5	9	17	0	13	12	89	5
37	Buckeye State	.....		.....		0	7	0	9	2	9	25	8	6	7	15	4	37	4	14	8	102	8
38	Perfection	0	11	.....		1	14	2	3	9	8	26	4	2	14	7	13	19	9	2	14	73	10

TABLE II.—Unsprayed, 1896.

Plot No.	Varieties.	DATE OF AND YIELD AT EACH PICKING.																			
		Aug. 18.		Aug. 22.		Aug. 26.		Aug. 29.		Sept. 7.		Sept. 16		Sept. 19.		Sept. 24.		Oct. 2.		Oct. 16.		Total.	
		Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.
1	Liv. Favorite	0	14	.....		2	12	1	11	9	14	27	8	2	1	4	3	5	7	2	4	56	10
2	Golden Queen	.....		0	9	0	15	0	14	5	10	11	8	4	8	4	2	15	0	5	3	48	5
3	Michigan Early	1	2	2	3	2	15	2	12	22	9	24	6	1	4	3	12	5	11	1	7	88	1
4	Trophy	.....		2	2	0	11	0	6	5	10	23	15	4	14	2	15	4	2	5	6	50	1
5	Liberty Bell	1	4	3	7	4	7	2	9	11	5	33	6	1	15	12	3	11	7	2	14	84	13
6	Atlantic Prize	1	0	1	14	3	11	1	7	10	6	16	10	0	11	2	5	2	6	.....		40	6
7	Royal Red	..	.....	3	2	4	5	4	4	10	14	26	3	4	4	5	2	12	8	7	9	78	3
8	Ponderosa	0	6	3	6	3	6	.....		11	0	32	10	18	0	2	5	3	6	21	0	60	9
9	Paragon	0	6	4	1	4	1	1	14	14	2	36	1	3	6	5	7	14	0	7	4	90	10
10	Matchless	0	15	2	10	1	7	1	4	14	10	24	0	4	6	2	10	10	8	8	0	70	6
11	Early Acme	4	4	5	0	3	6	2	8	13	2	25	1	2	9	1	10	7	1	1	14	66	7
12	Advance	2	11	4	10	4	12	3	14	22	6	31	13	1	11	1	12	3	2	.....		76	11
13	Democrat	0	15	2	1	..	.....	1	10	7	13	24	2	4	0	6	12	13	8	7	8	68	5
14	Autocrat	....	..	1	1	4	1	1	4	2	9	23	4	1	7	4	8	6	8	9	11	54	5
15	Canada Victor	2	2	6	1	5	9	3	9	32	1	27	8	2	6	2	9	6	2	1	2	89	1
16	Potato Leaf	2	13	7	3	3	4	3	10	13	10	37	6	2	2	5	3	14	4	.....		79	7
17	Rose Peach	0	5	1	2	1	14	1	5	11	2	20	1	9	1	6	8	7	0	5	14	64	4
18	Purple Peach	.....		0	3	0	13	.....		4	4	11	6	4	7	6	2	6	2	5	13	39	2
19	Golden Ball	1	15	1	0	0	13	2	2	8	14	11	4	4	12	7	15	11	9	7	5	57	9
20	Cincinnati Purple	1	15	2	7	1	2	3	7	16	0	23	12	1	6	6	3	13	6	4	10	74	4
21	New Imperial	5	3	3	10	2	15	3	6	24	11	28	6	1	10	3	6	5	14	3	9	82	10
22	Early Ruby	11	4	10	13	13	2	7	3	24	14	12	8	1	0	0	12	0	14	.....		82	6
23	Essex Hybrid	3	10	6	10	5	4	3	6	24	0	22	13	0	9	2	2	6	5	.....		74	11
24	Acme	2	10	5	9	5	5	1	10	17	2	13	14	0	8	2	4	8	10	.....		57	8
25	Beauty	1	15	10	11	3	3	2	4	20	0	14	1	2	2	1	0	5	3	..	.....	60	7
26	Dwarf Aristocrat	2	5	3	1	3	10	3	13	8	6	10	8	1	13	0	11	1	14	.....		35	1
27	Dwarf Champion	1	1	5	11	3	9	2	10	5	7	6	8	1	3	0	12	1	7	0	11	28	15
28	Purple Husk	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
29	Golden Husk	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
30	Golden Pear	.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....	
31	Truckers' Favorite	1	0	2	12	3	5	2	11	16	4	13	13	1	0	2	15	6	9	2	14	53	3
32	Ford Hook	4	2	7	13	5	0	5	6	23	1	11	1	0	12	1	12	3	14	0	9	63	6
33	Queen	3	3	5	3	5	0	4	0	20	5	22	12	2	3	1	1	5	12	2	4	71	11
34	Early Smooth	2	3	9	9	5	1	3	7	20	1	16	1	1	11	2	1	8	15	4	6	64	7
35	Prize Taker	3	9	4	6	2	9	1	14	15	2	24	2	0	13	2	5	6	5	1	8	62	9
36	Stone	.....		1	8	2	10	1	10	11	3	18	11	4	13	2	1	6	6	6	9	55	7
37	Buckeye State	.....		.....		1	5	0	4	5	2	25	11	3	12	4	14	11	13	11	3	64	0
38	Perfection	0	15	1	8	1	12	2	7	13	9	24	10	1	14	2	0	8	11	0	12	58	2

TABLE III.—Yield per Acre of Varieties of Tomatoes Sprayed and Unsprayed. 1896.

Plot. No.	Varieties.	Sprayed.		Unsprayed		Difference in Favor of Spraying.	
		Tons.	Bush.	Tons.	Bush.	Tons.	Bush.
1	Livingston Favorite	6.49	216.3	6.16	205.4	.33	10 9
2	Golden Queen	7.75	258.3	5 25	175 3	2 30	83 0
3	Michigan Early	9.58	319.4	7.41	247.1	2.17	72.3
4	Trophy	10 90	363.3	5.45	181.9	5.45	181.4
5	Liberty Bell	11.33	377.8	9.23	307.8	2.10	70 0
6	Atlantic Prize	10.41	347.0	4.39	146.6	6 02	200.4
7	Royal Red	10.95	365.3	8 51	283.8	2.44	81.5
8	Pondorosa	6.19	206.5	6.59	219.8	.....	.....
9	Paragon	12.12	404.0	9.86	328.8	1.26	75.2
10	Matchless	10.74	358.0	7.66	255.5	3.08	102.5
11	Early Acme	10 76	358.7	7.23	241.1	3.55	117.6
12	Advance	8.74	291.3	8.35	278 3	0.39	13.0
13	Democrat	10 12	337.3	8.25	275.0	1.87	62.3
14	Autocrat	11.11	370.2	5 91	197.1	5 20	173 1
15	Canada Victors	11.22	374 2	9.69	323.1	1.53	51.1
16	Potato Leaf	11.50	383.3	8.64	288 2	2 86	95 1
17	Rose Peach	12 98	432.7	6 99	233 0	5.99	199.7
18	Purple Peach	7.49	266.3	4 25	141.9	3.24	124 4
19	Golden Ball	10 28	342.7	6 95	231 7	4 02	134.0
20	Cincinnati Purple	8 86	295.3	8.08	269.3	.78	26 0
21	Imperial	12.36	412.0	8.99	299.6	3.37	112.4
22	Early Ruby	11.68	389.3	8.97	299.1	2.71	90.2
23	Essex Hybriod	9.96	332 0	8.13	271.1	1 83	60 9
24	Acme	8.62	287.5	6 26	208 7	2.36	78.8
25	Beauty	7.90	263.5	6.57	219.2	1.33	44.3
26	Dwarf Aristocrat	4.02	134 3	3.81	127 1	.21	7.2
27	Dwarf Champion	3.59	119.8	3.14	104.9	.45	14.9
28	Purple Husk	.....	.....	.....	.....	.....	.....
29	Golden Husk	.....	.....	.....	.....	.....	.....
30	Yellow Pear	.....	.....	.....	.....	.....	.....
31	Truckers' Favorite	8.52	284.2	5.78	192,7	2 74	91.5
32	Ford Hook	7.92	264 1	6 95	230.1	.97	34.0
33	Queen	8.87	295.7	7 80	260.2	1.07	35.5
34	Early Smooth	9.67	323.3	7.01	233 9	2.66	89.4
35	Prize Taker	10 88	362.8	6.80	226.9	4.08	135 9
36	Stone	9.71	323.9	6.03	201.1	3.66	122.8
37	Buckeye State	11.15	371.5	6 96	232.3	4.19	139.2
38	Perfection	8.01	267.2	6.32	210.9	1.69	56 3
	Average for thirty-five varieties.	9.52	.....	6.98	.....	2 51	.....

TABLE IV.—Quantity of Green Tomatoes of Different Varieties on Sprayed and Unsprayed Plots. 1896.

Plot No.	Varieties.	Sprayed.		Unsprayed.	
		Lbs.	Bush.	Lbs.	Bush.
1	Livingston Favorite	19.38	32.3	3.05	5.2
2	Golden Queen	46.82	78.0	11.76	19.6
3	Michigan Early	14.37	23.9	3.70	6.1
4	Trophy	38.72	64.5	8.28	13.8
5	Liberty Bell	26.14	58.4	3.05	5.1
6	Atlantic Prize	2.61	43.4	.....	.....
7	Royal Red	51.61	86.0	1.59	2.6
8	Ponderosa	22.15	96.9	3.05	5.1
9	Paragon	27.66	46 1	9.58	12.6
10	Matchless	10.89	18.1	9.80	16.3
11	Early Acme	6.97	11.6	.....	.....
12	Advance	1.96	3.2	8.93	14.9
13	Democrat	33.76	56.2	.....	.....
14	Autocrat	38.55	64 2	12.41	20.7
15	Canada Victor	5.88	9.8	.....	.....
16	Potato Leaf	3.28	5.4	.....	.....
17	Rose Peach	25.48	42.4	5 88	9.8
18	Purple Peach	22.43	37.3	11.76	19.6
19	Golden Ball	30.49	57.4	24.61	41.0
20	Cincinnati	29.62	49.3	4.35	7.2
21	New Imperial	11.11	18.5	4.14	6.9
22	Early Ruby	1.31	2.2	.....	.....
23	Essex Hybrid	1.74	2.9	.....	.....
24	Acme	3.27	5.4	.....	.....
25	Beauty	7.62	12.7	.....	.....
26	Dwarf Aristocrat	2.39	3.9	.....	.....
27	Dwarf Champion	1.52	2.5	.....	.....
28	Purple Husk	.....	.....	.....	.....
29	Golden Husk	.....	.....	.....	.....
30	Golden Pear	.....	.....	.....	.....
31	Truckers' Favorite	6.32	10 5	1.96	3.2
32	Ford Hook	1.96	3.2	1.31	2.2
33	Queen	8.48	14.1	3.70	6.1
34	Early Smooth	8 92	13 2	3.05	5.1
35	Prize Taker	4.14	6.7	1.96	3.2
36	Stone	20.25	33.7	3.92	6.5
37	Buckeye State	13.29	22.1	1.96	3.2
38	Perfection	1 96	3.2	.....	.....

TABLE V.—Results of Test of Varieties and Treatment for the Prevention of Tomato Blight.

YIELD OF PLOTS SPRAYED WITH BORDEAUX SOLUTION.

Size of Plots, 181½ Square Feet, 1897.

Plot No.	Variety.	DATE OF AND YIELD AT EACH PICKING.																									
		Aug. 14.		Aug 17.		Aug. 23.		Aug. 26.		Aug. 30.		Sept. 4.		Sept. 11.		Sept. 16.		Sept. 20.		Sept. 28.		Oct. 6.		Oct. 27.		Total.	
		Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz	Lbs.	Oz.
1	Atlantic Prize	0	4	0	15	2	0	2	0	6	1	5	11	12	1	9	3	7	3	3	3	2	13	2	9	54	9
2	Prize Winner	0	4	0	11	0	14	2	1	4	2	5	10	11	9	17	10	11	2	3	9	4	4	3	11	65	7
3	Brinton's Best	.....		.....		0	1	0	4	0	9	1	12	7	7	19	2	21	12	13	6	3	1	20	10	88	0
4	Favorite	.....		.....		.....		0	4	1	0	5	10	10	8	25	3	11	5	10	5	5	0	13	14	83	2
5	Queen	.....		.....		.....		.....		0	12	0	14	11	0	16	12	19	4	13	14	3	8	15	3	81	3
6	Stone	.....		.....		.....		.....		0	9	1	13	13	6	18	4	13	8	10	11	5	3	12	14	76	4
7	Prize Taker	.....		.....		0	2	.....		3	11	7	8	16	0	22	13	13	8	10	12	3	2	19	3	96	11
8	Matchless	.....		.....		.....		.....		3	3	5	1	15	6	15	14	12	0	9	1	6	9	25	3	92	5
9	Paragon	.....		.....		.....		.....		3	9	0	12	10	8	19	11	19	2	18	5	4	14	24	1	100	4
10	Royal Red	.....		.....		.....		.....		1	5	1	8	7	2	13	15	13	9	9	15	6	2	32	3	85	11
11	Perfection	.....		.....		0	9	0	9	2	6	1	14	10	6	19	2	18	14	14	8	7	8	27	6	102	12
12	World's Fair	.....		.....		0	12	.....		2	0	1	4	11	4	17	11	18	13	15	2	6	1	30	2	103	1
13	Beauty	.....		.....		.....		.....		1	12	1	4	6	7	7	12	10	8	11	6	7	5	37	15	84	5
14	Imperial	.....		.....		.....		.....		1	10	2	4	10	5	23	6	14	1	7	14	9	6	14	15	83	13
15	Golden Queen	.....		.....		0	5	.....		3	10	5	7	11	15	24	1	24	2	16	1	10	2	29	6	125	1
16	Climax	.....		.....		0	3	.....		2	5	5	10	11	0	27	15	17	13	11	2	7	8	20	4	103	12
17	Ford Hook	.....		.....		0	10	.....		2	12	4	14	10	14	19	1	10	5	11	6	8	14	12	14	81	8
18	Mayflower	.....		.....		.....		.....		0	5	0	14	2	2	14	2	9	12	11	9	7	10	15	8	61	14
19	Dwarf Champion	.....		.....		1	0	.....		2	0	0	15	5	14	11	3	9	8	6	3	3	9	3	8	43	12

TABLE VI.—Results of Test of Varieties of Tomatoes Not Sprayed.

YIELD BY PICKING AND PLOTS.

Size of Plots, 181½ Square Feet, 1897.

Plot No.	Variety.	DATE OF AND YIELD AT EACH PICKING.																															
		Aug. 10.		Aug. 14.		Aug. 17.		Aug. 23.		Aug. 26.		Aug. 30.		Sept. 4.		Sept. 11.		Sept. 16.		Sept. 20.		Sept. 28.		Oct. 6.		Oct. 27.		Total.							
		Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz	Lbs.	Oz	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.	Lbs.	Oz.						
1	Atlantic Prize....	0	2	0	2	2	8	1	4	4	6	5	6	6	2	1	10	2	1	0	10	0	13	0	0	0	0	35	0				
2	Prize Winner....	0	3	.....		0	10	2	4	2	15	6	4	13	1	11	0	7	14	2	8	0	9	.....		0	0	47	4				
3	Brinton's Best....	.....		.....		.....		0	5	0	14	1	2	6	7	11	12	18	8	8	2	4	2	1	15	4	12	57	15				
4	Favorite.....	.....		.....		0	7	0	7	0	15	2	9	5	13	5	7	16	1	7	9	4	1	0	6	4	8	48	3				
5	Queen.	.....		.....		.....		0	5	1	6	1	12	2	3	10	4	16	5	11	10	3	7	1	8	4	14	53	10				
6	Stone.....	.....		.....		.....		0	4	2	6	1	8	5	10	7	0	16	3	9	12	3	15	1	12	5	8	52	14				
7	Prize Taker..... .	.....		.....		.....		0	14	1	7	1	9	7	6	15	14	15	7	5	6	5	0	0	14	7	5	61	2				
8	Matchless.....	.....		.....		.....		0	8	0	14	3	5	5	14	17	1	22	11	9	12	9	4	4	10	18	12	92	11				
9	Paragon.....	.....		.....		.....		0	7	1	8	1	7	6	6	15	5	29	14	13	9	7	14	3	8	17	2	97	0				
10	Royal Red..... ...	.....		.....		.....		.....		1	7	2	1	2	3	6	15	22	10	14	14	8	7	6	11	27	5	92	9				
11	Perfection.....	.....		.....		.....		0	2	1	0	1	10	2	8	6	6	23	4	11	2	9	2	8	1	13	4	73	7				
12	World's Fair.....	.....		.....		.....		0	2	.....	.....	3	8	7	3	10	1	23	6	14	10	10	9	7	12	29	7	87	5				
13	Beauty.....	.....		.....		.....		0	2	2	6	0	12	1	13	11	15	19	0	10	15	7	5	5	2	14	9	73	15				
14	Imperial.....	.....		.....		.....		0	12	2	10	3	12	2	11	10	7	21	9	11	14	4	0	1	13	2	11	62	3				
15	Golden Queen....	.....		.....		.....		0	14	1	12	2	9	6	10	16	0	32	2	12	2	6	8	4	3	8	8	91	4				
16	Climax.....	.....		.....		.....		0	9	0	15	2	7	6	4	10	9	20	0	13	1	3	14	4	4	10	2	72	1				
17	Ford Hook.....	.....		.....		.....		1	10	2	8	2	12	7	4	12	2	23	5	10	9	5	2	3	1	3	2	72	12				
18	Mayflower..	.....		.....		.....		.....		0	11	1	8	1	6	5	13	25	7	8	6	8	10	8	5	12	4	72	6				
19	Dwarf Champion	.....		.....		.....		1	3	0	13	2	5	5	8	7	0	9	2	3	8	1	5	0	10	0	7	31	13				

TABLE VII.—Yield per Acre of Varieties of Tomatoes Sprayed and Unsprayed. 1897.

Plot No.	Varieties.	Sprayed.		Unsprayed.		Difference in Favor of Spraying.	
		Tons.	Bush.	Tons.	Bush.	Tons.	Bush.
1	Atlantic Prize	6.54	218.0	4.20	140.0	2.34	78.0
2	Prize Winner	7.84	261.6	5.66	188.8	2.18	72.8
3	Brinton's Best	10.55	351.9	6.97	232.4	3.58	119.5
4	Livingston's Favorite	9.97	332.4	5.85	195.1	4.12	137.3
5	Queen	9.74	324.7	6.43	214.4	3.31	110.3
6	Stone	9.14	304.7	6.34	211.5	2.80	93.4
7	Prize Taker	11.60	386.9	7.33	244.3	4.27	142.6
8	Matchless	11.07	369.2	11.12	370.8	.....	.....
9	Paragon	12 02	400.8	11.63	387.9	0.39	12.9
10	Royal Red	10 22	340.8	11.11	370.3	.....	.....
11	Perfection	12.33	411.1	8.80	293.6	3.53	117.5
12	World's Fair	12 44	414.8	12.78	426.0	.....	.....
13	Beauty	10.11	337.2	8.86	295.5	1.25	41.7
14	Imperial	10.05	335 1	7.45	248.4	2.60	86.7
15	Golden Queen	15.01	500.4	10.94	364 7	4.07	135.7
16	Climax	12.44	414.8	8.65	288.4	3.79	126.4
17	Ford Hook	9.78	326.0	8.65	288.4	1.13	37.6
18	May Flower*	8.90	296.7	8.68	289.2	0.22	7.5
19	Dwarf Champion	5.25	175.2	3.86	127.2	1.39	48.0
	Average of nineteen varieties	10.26	.....	8.11	.....	2.15	.....

*Yield corrected for one plant missing in the sprayed portion.

TABLE VIII.—Quantity of Green Tomatoes of the Different Varieties on the Sprayed and Unsprayed Plots. 1897.
(Calculated in Pounds and Bushels per Acre.)

	Varieties.	Sprayed.		Unsprayed.	
		Lbs.	Bush.	Lbs.	Bush.
1	Atlantic Prize	5.04	8.4	.....	.....
2	Prize Winner	7.68	12.8	.....	.....
3	Brinton's Best	24.48	40.8	15.12	25.2
4	Favorite	17.04	28.4	12.24	20.4
5	Queen	21.12	35.2	7.20	12.0
6	Stone	23.52	39.2	19.20	32.0
7	Prize Taker	14.64	24.4	15.12	25.2
8	Matchless	36.00	60.0	19.68	32.8
9	Paragon	29.04	48.4	20.40	34.0
10	Royal Red	54.96	91.6	36.24	60.4
11	Perfection	17.04	28.4	22.80	38.0
12	World's Fair	54.24	90.4	24.00	40.0
13	Beauty	45.60	76.0	12.48	20.8
14	Imperial	20.40	34.0	21.84	36.4
15	Golden Queen	30.00	50.0	17.04	28.4
16	Climax	8.88	14.8	20 16	33.6
17	Ford Hook	4.56	7.6	4.80	8.0
18	Mayflower	17.76	29.6	13.68	22.8
19	Dwarf Champion	.....	.....	.....	.....

TABLE IX.—Average Results of Spraying of Varieties Tested Two Years.
(Yields per Acre.)

	Varieties.	1896.		1897.		Average.	
		Sprayed.	Not Sprayed	Sprayed.	Not Sprayed.	Sprayed.	Not Sprayed.
		Tons	Tons.	Tons	Tons.	Tons.	Tons.
1	Favorite	6.49	6.16	9 97	5.85	8.23	6.00
2	Golden Queen	6.98	5.25	15.01	10.94	10.99	8.09
3	Atlantic Prize	10.41	4.39	6.54	4.20	8.47	4.29
4	Royal Red	10.95	8.51	10.22	11.11	10.58	9.81
5	Paragon	12.12	9.86	12.02	11.63	12.07	10.74
6	Matchless	10.74	7.66	11 07	11.12	10.90	9 39
7	Imperial	9.89	8.99	10.05	7.45	9.97	8.22
8	Beauty	7.90	6 57	10.11	8.86	9 00	7.71
9	Dwarf Champion	3.59	3.14	5.25	3.80	4.42	3.50
10	Ford Hook	7.92	6.95	9.78	8.65	8.85	7.80
11	Queen	8.87	7.80	9.74	6.43	9 80	7.11
12	Prize Taker	10.88	6.80	11 60	7.33	11.24	7.06
13	Stone	9.71	6.03	9 14	6.34	9.42	6.18
14	Perfection	8 01	6 33	12 33	8 80	10.17	7.56

ERRATA:—There should be no decimal point in the pound columns in tables 4 and 8.

On page 125, lines 12 and 17, read "6 lbs.," instead of "8 lbs."

Page 118, line 18, "statement" should read "State."

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 55.

The Black Peach Aphis—Cut Worms in Young Tobacco—Law Providing for the Suppression and Control of Insect Pests and Plant Diseases in Maryland.

COLLEGE PARK, MD.

MAY, 1898.

MARYLAND

Agricultural Experiment Station.

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NOTICE.

The bulletins of the Station will be mailed free to any citizen of Maryland who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or any failure to receive the bulletins.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

The Black Peach Aphis—Cut Worms in Young Tobacco—Law Providing for the Suppression and Control of Insect Pests and Plant Diseases in Maryland.

By W. G. Johnson, Entomologist.

THE BLACK PEACH APHIS

(Aphis prunicola Kalt.)

The black peach aphis has made its appearance in certain sections of the State in such unusual numbers, we have deemed it expedient to embody an account of it in this bulletin, calling especial attention to it. Great injury is being done to the unfolding buds in nurseries, and to young trees set out this spring and last fall. In one instance the pest is in a single block of peach in which over a million seedling were budded last season. At another place a block of five hundred thousand trees are being seriously damaged. I was called to this nursery by telegram, April 20th, and upon examination found that considerably over one hundred thousand young trees, where the buds were just starting, were literally covered with the insects. The creatures were clustered upon the young shoots, to such an extent that the rows looked as if they had been dusted with lamp black. The general appearance of one of these young trees is shown in figure 1, at *a*. The insects are so thickly clustered upon the young shooting bud, it can scarcely be seen. A normal bud, as it should be, is shown at *b*. A leaf with the insects on the under surface is shown at *c*. A correspondent from Washington County says in a letter April 21st, that he is having a great deal of trouble with this insect on peach planted this spring and upon plum set out one year ago.

Nature of the Attack. —The ravages of this pest in the past have been very great, and I hope this circular will be timely warning to many nurserymen and orchardists who might otherwise suffer considerable loss. Trees badly attacked by this insect are very conspicuous even at a distance. The leaves are yellowish, more or less clustered, many of them being curled and spotted. The result is that the tree is dwarfed and stunted; and in the case of young buds in the nursery, they are killed outright in a very

Fig. 1.—Injury to young peach buds. *a*, bud covered with black peach aphis; *b*, normal bud; *c*, leaf with insects on under surface. (Original.)

few days. The insect is sometimes called the black peach louse, and if a cluster of them is examined, winged and wingless individuals, and young from the newly born in all stages to the adult, will be seen. One of the wingless viviparous forms is shown at figure 2. There may also be seen in the same colony many winged forms as shown in figure 3. The young of these insects are produced alive and unlike most other plant lice, they spend part of their time upon the roots in the ground, retiring about midsummer and remaining below the surface until the following spring.

Fig. 2.—Common Wingless Female of the Black Peach Aphis. (After Slingerland).

Remedial Measures.—Of the remedial measures suggested and tried I have found kerosene emulsion the most effective. The degree of success attained will depend (1) upon the completeness of the emulsion, (2) the kind of apparatus used for applying it, and (3) the thoroughness of the spraying.

Fig. 3.—Common Winged Female of the Black Peach Aphis. (After J. B. Smith.)

Kerosene emulsion must be made explicitly according to the directions as oil and water will not mix by stirring, or by pouring from one vessel to another. It is made as follows:—

Hard (or soft) soap (ivory soap preferable).....½ pound.
Water (rain water if convenient).....1 gallon.
Kerosene (common coal oil).....2 gallons.

Put the water in a vessel holding four or five gallons, add the soap by shaving it into thin pieces, place on a stove and bring to the boiling point, occasionally stirring it to thoroughly dissolve the soap; then re-

move to the yard, or some convenient place away from the fire, and pour the kerosene directly into the water. This should then be pumped in and out of the vessel with a good force pump for from five to ten minutes or until the emulsion is formed. If properly made, it will have the appearance of buttermilk, and will readily mix with water without any oil coming to the surface. It will keep an indefinite length of time, becoming a semi-solid when cold. If used when fresh it can be diluted with cold water to the strength desired; but if cold and hard, warm water should be used. Every gallon of the emulsion used should be diluted with from 10 to 12 gallons of water, and applied with a good spray pump.

There is now upon the market a spraying apparatus which mechanically mixes kerosene with water, and does away with the seemingly troublesome method, although it is very simple in practice, of making the emulsion by hand. There are several styles of these machines, one is made so that it can be used in any ordinary pail and and costs about $7.00. The Knapsack costs about $14.00, and the barrel as shown in figure 4, about $16.00. I have found these sprayers the most satisfactory I have ever used in combatting plant lice. To operate figure 4, it is only necessary to fill the tank with pure kerosene, the barrel with clean water, set the indicator at the figure giving the percentage desired and everything is in readiness. From a series of tests made with one of these sprayers, April 21st, 1898, we have found that 15 per cent. kerosene and water gave us the most satisfactory results. The tests ranged from 5 to 30 per cent.

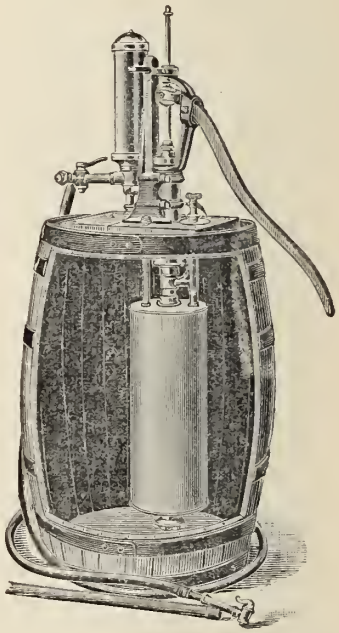

Figure 4.—The Peerless Kerosene Sprayer. (After The Deming Co.)

Where only a few branches of small one year old trees are found infested it would be wise to cut them off and burn them. If for any reason it is desired to save them, the branches should be bent over and dipped in a soap solution at the rate of 1 pound of soap to 7 gallons of water. An efficient and cheap mixture can also be made by soaking 8 to 10 pounds of home-grown tobacco leaves and stems in 40 gallons of water for two days (48 hours). Dissolve 2 pounds of whale oil or soft soap in a gallon of hot water, add to the barrel of tobacco infusion, stir thoroughly and apply with a good spray pump or dip the infested branches in it.

For a more detailed account of some common injurious plant lice, with suggestions for their destruction, See Bulletin 48 of the Maryland Agricultural Experiment Station, a copy of which will be sent upon application.

CUT WORMS IN YOUNG TOBACCO.

For many years the tobacco growers of Maryland have suffered serious annual loss from the ravages of cut worms. These losses are becoming more apparent in sections where crimson clover and other crops are grown on the tobacco lands for turning down in the spring as a soil crop. Such fields furnish ideal places, the early and latter part of the season, for the parent insects to deposit their eggs and for the young worms to feed. The result is, that when the crop is turned under, the worms remain below the ground for a time feeding upon the leaves, stems and roots, until the tobacco plants are set out, and then they emerge from their subterranean hiding places and concentrate their attacks upon the delicate plants. The damage thus done is very great as it necessitates replanting, and in many instances, the second planting is cut off. Consequently, the grower is not only annoyed by worms but the unevenness of his crop is very noticeable, and causes much trouble and extra expense in handling as it does not ripen uniformly.

For the past two seasons this office has received many inquiries regarding these insects, and anticipating similar requests for information this spring, we have thought it wise to issue these notes with suggestions for the general information of tobacco growers.

Generalized History.—The caterpillars or worms, commonly called cut worms are the young of a great family of night flying moths known as Noctuids. The moths are rarely ever seen in the day time, and dart here and there when disturbed. They hide during the day in grass and weeds, under stones and rubbish of all kinds, in fact, any place where they can find shelter. Many of them exhibit remarkable instances of protective coloration and can only be detected by very careful observation.

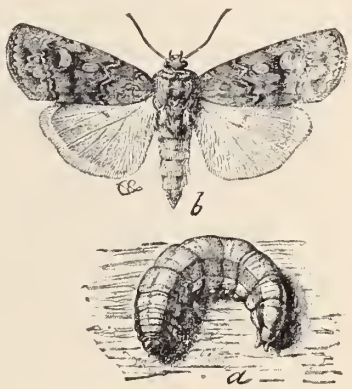

Fig. 5.—Dark-sided Cut Worm, *Agrotis messoria*, Harr. *a*, larva; *b*, adult moth. (After Riley.)

They are very active at night and certain species are attracted to lights in great numbers. They also have a special liking for sweets, and entomologists make use of this peculiar habit, catching them for study, by painting fence boards, trees, etc., with a mixture of molasses and stale beer. Thus many species are trapped and caught that it would be difficult to get otherwise.

The parent insects or moths of the common cut worms, are seen almost daily or nightly by the tobacco grower, but they are not usually recognized as the progenitors of the destructive worms. The moths vary greatly in color in the different species, and usually have a wing expanse of from an inch and a half to two inches as seen by the accom-

panying illustrations. Normally, the female lays her eggs in grass lands, but clover fields and weedy places get their share. The female will deposit her eggs most any place where the ground is densely covered with

Fig. 6.—Glassy Cut Worm, *Hadena devastatrix*, Brace. (After Riley.)

vegetation. The eggs are rarely ever laid on or in the ground, but are frequently found on trees, stones, or leaves.

The young worms hatching from these eggs early in the summer or late fall, feed voraciously upon any vegetation in their vicinity, and are by no means particular what it is; the only requirement being that the plant shall be juicy and abundant. Many worms of certain species reach about half their growth when winter sets in. They remain in the ground until the following spring and then renew their feeding with great activity. Some varieties assume a climbing habit and cut leaves and twigs of young trees and shrubs, and are therefore called "climbing cutworms." This climbing tendency is rarely exhibited where there is an abundance of vegetation on the ground.

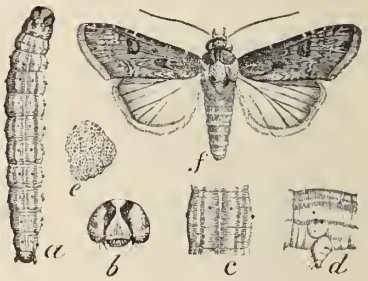

Figure 7.—Shagreened Cut Worm, *Feltia malefida*, Guen. (After Riley.)

When fully grown the worms vary in length from one to two inches or more. They also vary greatly in color and different species are usually easily recognized at a glance. For instance, the one shown at figure 5, is known as the dark sided cut worm, on account of the dark stripes extending along the sides of its body. For a similar reason, the one shown in figure 6 is known as the glassy cut worm, and the one in figure 7 as the shagreened cut worm, while figure 8 is called granulated cut worm.

One of the commonest forms we have in Maryland, especially in the tobacco growing counties, is known as the greasy or black cut worm. Another very common species in this State is known as the variegated cut worm. When these caterpillars reach maturity they enter the ground usually just below the surface and transform into what is known as the pupa or quiescent stage. A pupa of the granulated cut worm is shown in figure 8 at *f*. After remaining in this condition for a few days in midsummer the adult or parent moth emerges and is ready to deposit the eggs for the next brood in some suitable place.

It must be said in this connection that this is only a generalization

of the life history of this destructive group of insects, and will apply to a large number of species. Some of them vary considerably in habits and mode of transformation. Some live over winter in the adult stage, while others remain in the larva or pupa condition during that time. But in some instances we have found both the adult, nearly full grown larva and pupa, during the winter. Some species are double brooded, that is, there are two distinct broods during the same season, while others have but a single brood.

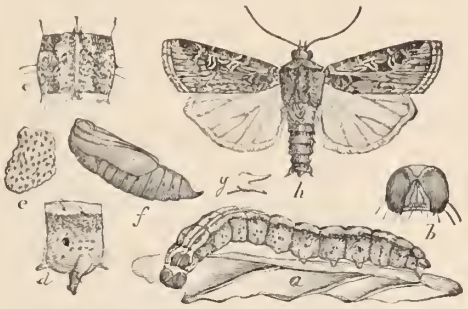

Fig. 8.—Granulated Cut Worm, *Feltia annexa*, Treits. (After Riley.)

The adults of the cut worms usually found in our tobacco fields appear generally during the month of July. The parent moth of the greasy cut worm (*Agrotis ypsilon*) began emerging in my breeding cages here July 19th, 1897. The worms were found abundant in tobacco fields the latter part of May and early June, doing considerable damage to the young plants. I also bred the adult from another species found in tobacco, known as the variegated cut worm (*Peridroma saucia*). The first moth appeared July 2nd, 1897.

Assuming that these general remarks will suffice to answer the queries usually asked rgarding cut worms, we will now turn our attention to the remedial measures.

Remedial Measures. —Many suggestions have been made, and many remedies tried for the destruction of cut worms, but none of them have given such marked and promising results as the poison bait. One year ago the remedy for the destruction of the cut worm was under discussion at the "Farmer's Club" at Bel Alton, Charles Co., and I was asked by the President of that organization, Samuel Cox, Jr., to prepare a reply to the query, and submit it to be read at their regular meeting. This paper was written March 15, 1897, read at their April meeting, and published in the County papers. As a result many farmers used the remedy suggested with gratifying results.

We know that the worm, as well as the adult moths, have a liking for sweet substances, and are attracted to them when they are placed in their vicinity. We also know that the worms eat wheat bran, with much relish. By combining, therefore, the bran with molasses, or syrup made from sugar, we have an ideal bait, and the worms will eat it in preference to anything else when it is available. By poisoning this material with Paris green or arsenic we have a good remedy, cheap and easy to apply.

The ingredients used for making the poison mash are as follows:

Wheat bran.....50 lbs.
Molasses (any kind)..... 2 quarts.
Paris green (good quality)..... 1 lb.
Water (enough to make thick mash)

The bran should be placed in an old tub or barrel, and to this the Paris green should be added and stirred thoroughly with a shovel or other implement before the water or molasses is poured in. Stir the molasses in about a gallon of warm water and pour it over the bran and Paris green, thoroughly stirring until it is well mixed. Then add enough water to maks a mash about the consistency of dough, so that it can be handled easily without running.

The material having been prepared it is now ready to be applied, and to do this successfully, several essentials are necessary.

(1) The land should be prepared several days in advance.

(2) After the drills are made, a pinch of poison mash, about as much as one could hold on a table spoon, should be dropped in the vicinity (*not in the exact place*) of the spot where the plant will be set. This should be done from *three* to *five* days before the plants are put out.

(3) The application should be made in the afternoon as near evening as practicable; but where it is necessary, in order to get over large areas, there is no objection to dropping it in at time during the day.

(4) Care should taken to keep chickens, turkeys, or animals of any kind that would be liable to eat the mash, out of the field for a day or two, or until after the tobacco is set.

This remedy is so simple and inexpensive, there is no good reason why the farmers of this State should loose so heavily each season from the attacks of these worms. The remedy can also be applied to any other plants or crop that is attacked by cut worms. It can be used to good advantage by onion, tomato and cabbage growers.

One of my correspondents, Henry C. Adams, of Mechaniesville, St. Mary's County, one of the largest and most successful tobacco growers in Maryland, who used this remedy last year writes me February 8th, as follows:—

"Last spring, a few weeks before planting my tobacco, I noticed in a Charles County paper, a remedy suggested by you, for the extermination of cut worms. I adoped it and the results were first class. After preparing the drills I applied a small quantity of the preparation suggested by you, near the place where the plant was to be set. The cut worms readily came up, ate it, and were killed before the planting of the tobacco. There would often be five or six dead worms lying on a hill, and I had no trouble, whatever, in getting a good stand of tobacco. Without the remedy, I do not believe I could have gotten a stand at all, with the number of worms in the ground. At any rate, the crop would not have been uniform. The remedy is inexpensive and not to be compared with the expense and bother of replanting, which I consider one of the most aggravating and life destroying jobs done on a farm. The suggestions made by you is worth a great deal to me, and supplies a need which the farmers have been wishing for so long."

THE NEW LAW PROVIDING FOR THE SUPPRESSION AND CONTROL OF INSECT PESTS AND PLANT DISEASES IN MARYLAND.

On account of the serious ravages of certain insect pests and plant diseases which have greatly interfered with the horticultural, agricultural and nursery interests of this State, it was deemed wise and expedient by those whose interests were represented, that they ask the State to make provision for the establishment and support of a department which should subserve their interests along certain lines.

The bill which follows, was therefore, the outcome of a convention which convened in Baltimore, January 26 and 27, 1898. The subject was carefully considered from the standpoint of the horticulturist, agriculturalist, nurseryman, trucker, florist, and from the practical and scientific sides.

The measure provides for the creation of a State Horticultural Department, which is under the immediate control of the Board of Trustees of the Maryland Agricultural College and Experiment Station. The State officers, whose duties are specifically designed, are professors of their respective departments, entomology, pathology and horticulture in the College and Station. Aside from their work as teachers and experimentors, the entomologist and pathologist, are required to ascertain, by inspection, the general horticultural and agricultural condition prevailing in each county each year; and must inspect each nursery every six months. These officers are given full police power to enter upon any land in the State for purposes of inspection or experimentation.

It is unlawful for any transportation company, person, or firm to deliver any kind of nursery stock to any person within this State, unless it is first covered by a certificate of inspection. The penalties attached for the violation of this law are severe.

It is not the intention of the officers charged with execution of this Act, to enforce its provisions for any selfish motives; but in view of the fact that our own orchardists, agriculturalists and nurserymen must submit to the provisions bearing directly upon their interests, we feel justified in saying that we expect those outside our State, doing a nursery business within our territory, to respect our wishes, and co-operate with us in the suppression and control of these pests so far as is practicable.

The departments are now being thoroughly equipped for the prosecution of the work to the very best advantage. Whenever it is practicable the apparatus belonging to these departments will be taken to various places in the State whenever an emergency arises. The officers will give as much time and personal attention to each important outbreak of insect or disease as the funds and assistance at their disposal will permit.

It is the desire of the officers of this department to keep in touch with the people of the State on topics of economic importance and all

inquiries will be given prompt and considerate attention. If there is an outbreak of any insect or disease in your vicinity, or an insect or diseased leaf or plant about which you desire information, enclose it in a small box or envelope to our address. Co-operation is necessary to get the greatest possible benefit out of this work. It will be impossible for the State Officers to know the exact conditions over the entire State at any one time, unless those for whose interest this department was created, keep them posted. For the benefit of the general public we append herewith, an exact copy of our State law.

LAWS OF MARYLAND, 1898.

CHAPTER 289.

An Act to repeal Sections 51, 52, 53, 54, 55, 56, 57 and 58 of Article XLVIII of the Code of Public General Laws, title "Inspections," sub-title, "Trees and Nursery Stock," as designated by Chapter 290 of the Acts of the General Assembly of Maryland of 1896; and to re-enact the same with amendments, under a new sub-title, to be known as "State Horticultural Department," and to add thereto eight new sections, to be designated 59, 59 A, 60, 61, 62, 63, 64 and 65, providing for the protection of the horticultural interests of the State by the suppression and extermination of the San Jose scale, peach yellows, pear blight and other injurious insect pests and plant diseases; and to create the offices of "State Entomologist," "State Pathologist," and "State Horticulturalist," and to appropriate a sum of money therefor.

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That sections 51, 52, 53, 54, 55, 56, 57 and 58, of Article XLVIII of the Code of Public General Laws, title "Inspections," sub-title, "Trees and Nursery Stock," as passed by the General Assembly of Maryland, session 1896, be and the same are hereby repealed and re-enacted to read as follows:

51. That a State Horticultural Department be established for the State of Maryland; that its purpose is to suppress and eradicate the San Jose scale, peach yellows, pear-blight, and other injuriously dangerous insect pests and plant diseases throughout the State of Maryland.

52. That the Professor of Entomology, the Professor of Vegetable Pathology, and the Professor of Horticulture of the Maryland Agricultural College and Experiment Station shall be the State Entomologist, State Pathologist and State Horticulturalist, respectively.

53. That the said Horticultural Department shall be under the control of the Board of Trustees of the Maryland Agricultural College and Experiment Station, to whom the officers created under this Act shall be responsible; that the salary of the State Entomologist and State Pathologist shall be fixed by the said Board of Trustees, and the said Board shall likewise fix the compensation of any assistant or assistants, employee or employees, and control all expenses thereof. That the expenses of said department shall be paid out of an appropriation hereinafter provided for, and that said Board of Trustees be invested with all powers necessary to carry into effect the provisions of this Act; but no expenses shall be incurred beyond the amount appropriated.

54. That it shall be the duty of said State Entomologist and State Pathologist, their assistants and employees, under the control of Trustees of said College, to seek out and suppress all pernicious insect pests and contagious diseases hereinbefore mentioned as destructive to the horticultural and agricultural interests of this State, and conduct experiments when necessary to accomplish that end.

55. That in order to accomplish the purposes of this Act, the State Entomologist and the State Pathologist, their assistants and employees, or any other officer, assistant or employee appointed by said Board of Trustees, are hereby authorized to enter upon

any public premises, parks, cemeteries, or other premises, or upon any land of any firm, corporation or private individual within the State of Maryland, for the purpose of inspecting, destroying, treating or experimenting upon the insects and diseases aforesaid. Should any insect or disease found by said State Entomologist or State Pathologist, or by any other officer appointed by said Trustees, be, in their opinion, capable of eradication without the destruction of the tree or plant, then said officers are to treat or cause to be treated with proper remedies and appliances all such trees, vines, shrubs, plants and grains. Further, said State officers shall treat or have treated, in order to prevent the dissemination of the aforesaid insects or diseases, any and all suspicious trees, vines, shrubs, plants and grains found to be in a dangerous proximity to those infested as aforesaid.

56. That should any of the officers aforesaid, through their assistants and employees, or by any notification whatsoever, find any fruit trees, vines, shrubs, plants or grains infested or diseased with the aforesaid insects or diseases, the aforesaid officers shall mark or tag in some conspicuous way all trees, vines, shrubs, plants or grains infested with the aforesaid diseases, and shall give notice in writing to the owner or owners, tenants or person in charge of such premises of the condition thereof, and thereupon, if such person or persons so notified shall not within ten (10) days after notification, destroy or treat the same in accordance with regulations and rules of said Trustees, a copy of which will be sent on application to any person, then said Trustees shall, through their officers, assistants or employees, destroy or treat all such trees, plants, vines, shrubs and grains, and the State officers shall file a statement of the expenses of such destruction or treatment with the Trustees of said College, and said Trustees shall transmit a copy of such statement and account of such expenditure, with the usual affidavit attached thereto, to be made by the State officers, which shall be sufficient evidence to prove the claim to the State's Attorney of the county where the owner of such premises resides, and said Attorney is directed to collect the same and account to the Trustees of the Maryland Agricultural College therefor.

57. That it shall be the duty of said Trustees to send the State Entomologist, or the State Pathologist, or their duly authorized assistants, at least once a year into each county of the State for the purpose of determining by inspection the healthfulness and general condition of the horticultural and agricultural interests.

58. That it is hereby also made the duty of the said Board of Trustees, through the State Entomologist, and the State Pathologist, or their duly authorized assistants, to inspect at least once in every six (6) months all nurseries, of trees, vines, shrubs and plants, subject to the aforesaid insects or diseases, within the State, and if found free, so far as can be determined by inspection, from the aforesaid insects or diseases, to give to the owner or owners, or persons in charge of said nurseries, a certificate of inspection, showing such nurseries or premises to be apparently free from such insects and diseases. If any of the aforesaid insects or diseases should be found in any nursery or orchard, or any premises within the State where nursery stock is grown, the aforesaid officers shall cause to be destroyed or treated such portion of such nursery stock, or other trees or plants, as in their opinion may be necessary, and shall release all other nursery stock grown upon said premises, and issue a certificate of inspection to the owner or owners, as herein provided for; and if such infested or diseased trees, vines, plants or shrubs, be destroyed by the aforesaid officers, then the owners shall pay the cost thereof, and if he refuse to pay the same, it shall be collected as prescribed in Section 56. No nurseryman, broker, agent, dealer or other person shall be permitted to sell, ship, send out, or give way, by mail, express, freight, or otherwise, any trees, vines, shrubs, plants, buds or cuttings from any such nurseries or premises, without accompanying the same, with a copy of the said certificate printed upon a tag or label, not easily destroyed,, the same to be firmly attached in some conspicuous position upon each car-load, box, bale or package so sent out or delivered.

SECTION 2. AND BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That the following sections be and the same are hereby added to Article XLVIII of the Code of Public General Laws, title "Inspections," sub-title "Horticultural Department," to be designated as Sections 59, 59 A, 60, 61, 62, 63, 64 and 65.

59. That should any nurseryman, agent, broker, dealer or other person send out or deliver within the State, or transport to any other State or Territory, or the District of Columbia, trees, vines, shrubs, plants, buds or cuttings, subject to the attacks of insects and diseases above provided for, without attaching a copy of said certificate, deface or destroy said certificate, or wrongfully attach a certificate, he shall be adjudged guilty of a misdemeanor, and shall, upon conviction, before any Justice of the Peace, be fined a sum not less than ten dollars ($10.00) or more than one hundred dollars ($100.00) and costs of prosecution for each and every offense, and stand committed until such fine and costs are paid, and the fines so collected shall be paid to the Trustees of the said College, and be added to the funds herein provided for carrying out the provisions of this Act.

59 A. That all trees, plants, vines, shrubs, buds or cuttings, commonly known as nursery stock, grown or handled by each and every nurseryman within this State, and subject to the attacks of the aforesaid insects or diseases, shall be fumigated by the nurseryman owning the same, with hydrocyanic acid gas in buildings or enclosures inspected and approved by the aforesaid State officers, under their direction.

60. That when any trees, plants, shrubs, vines, buds or cuttings, commonly known as nursery stock, are shipped into this State from any other State or Territory, or the District of Columbia, to any nurseryman, broker, dealer, agent or other person in this State, every car-load, bale, box or package thereof, shall be plainly labeled on the outside with the name of the consignor, the name of the consignee, and a certificate showing that the contents have been inspected by a qualified State or government officer, and that the trees, plants, vines, shrubs or cuttings therein contained are apparently free from the insects and diseases herein provided for. Whenever any trees, plants, vines, shrubs, buds or cuttings are shipped into this State from any other State or Territory, or the District of Columbia, without such certificate plainly fixed on the outside of each car-load, box, bale or package, the agent of the transportation company, firm or person receiving same, shall not deliver said nursery stock to the consignee or agent representing the consignor, and said agent of the transportation company, firm or person, shall notify the State Entomologist or State Pathologist, at the Maryland Agricultural College, and the State officer receiving such notification shall immediately notify any Justice of the Peace of this State to issue a summons for the consignee, and the agent or consignor, if he be known, of such car-load, box, bale or package of nursery stock, to appear before him, on a certain day to be named herein, to show why such trees, plants, vines, shrubs, buds or cuttings should not be seized as being in violation of the provisions of this Act, and on trial thereof, if said Justice be satisfied that the provisions of this Act have been violated, said Justice shall order said agent, or consignee, to return such car-load, box, bale, package of trees, plants, shrubs, vines, buds or cuttings immediately to the shipper or consignor, unless said consignee, or agent of the consignor, at his expense, shall forthwith have said nursery stock examined by the State Entomologist and State Pathologist of this State, and such officers certify to such Justice of the Peace that said nursery stock is apparently free from the insects and diseases mentioned herein, and tag every such car-load, box, bale and package inspected by said officers, with their certificate of inspection, and if said agent or consignee shall fail to have said nursery stock examined by said State officials, or fail to return such car-load, box, bale or package thereof, then said Justice of the Peace shall order and direct the sheriff or constable to burn and destroy all such trees, plants, shrubs, vines, buds or cuttings that have been shipped into this State in violation of this Act.

61. That whenever any agent of a transportation company, firm or person, shall receive a car-load, box, bale or package of trees, plants, shrubs,

vines, buds or cuttings, without a certificate attached, as provided for in Section 60 of this Act, and shall fail to notify the State Entomologist or State Pathologist of this fact, immediately upon the arrival of such nursery stock, and before delivering the same to the consignee, said agent of the transportation company, firm or person, shall be adjudged guilty of a misdemeanor, and shall, upon conviction, before a Justice of the Peace, be fined a sum not less than ten dollars ($10.00) nor more than one hundred dollars ($100.00), and costs of prosecution for each and every offense, and stand committed until such fine and costs are paid, and the fines collected shall be paid to the Trustees of said College, to be added to the fund herein provided for, carrying out the provisions of this Act. If any nurseryman, dealer or agent, sell, ship or deliver any trees, plants, shrubs or vines, into this State which are infested with San Jose scale, peach-yellows, pear blight or other injuriously dangerous insects or diseases, and upon examination by the State Entomologist and State Pathologist, or their assistants, are condemned as being so infested, the said trees, plants, vines and shrubs shall be destroyed, and the nurseryman, dealer or agent forfeit the value of such stock, and shall not collect the same from the purchaser or consignee.

62. That the State Entomologist, State Pathologist and State Horticulturalist shall submit annually a written report on or before the first day of February, of their inspections and investigations, to the Board of Trustees, which shall be transmitted to the Governor of this State and the General Assembly, and published, as are the reports of other State organizations, and distributed among the people of the State as bulletins of the Maryland Agricultural Experiment Station.

63. That the report of the present State Entomologist, including the work done by him up to the date of the passage of this Act, shall be published and distributed as indicated and provided for in Section 62 of this Act, as the first annual report of the Maryland State Entomologist.

64. That the sum of ten thousand dollars the first year, and eight thousand dollars annually thereafter, be and is hereafter appropriated in order to carry out the provisions of this Act and properly provide for the above described inspections; to employ men qualified for their respective positions; to procure the requisite facilities and equipment necessary for the proper performance of the duties herein incurred, and to offer means of support for investigation in addition to the inspection work of the State officers, and the dissemination of information that will promote the horticultural and agricultural interests of this State.

65. That the Comptroller be and that he is hereby authorized to issue his warrant upon the Treasurer of this State for the said sum of ten thousand dollars for the year eighteen hundred and ninety-eight, and the sum of eight thousand dollars annually thereafter, out of any funds not otherwise appropriated; that the said sum of money shall be payable to the Maryland Agricultural College on or before the first of October of each fiscal year, and the first yearly payment shall be made during the fiscal year ending September 1st, eighteen hundred and ninety-eight.

Section 3. AND BE IT ENACTED, That this Act shall take effect from the date of its passage.

Approved April 9th, 1898.

This is the first bulletin published according to the provisions embodied in Section 64 of this Act, giving general information to the public on topics of economic importance. Others will follow as occasion demands.

MARYLAND

Agricultural Experiment Station.

BULLETIN NO. 56.

Wheat, Winter Oats, Barley and Lime Experiments.

COLLEGE PARK, MD.

JUNE, 1898.

MARYLAND

Agricultural Experiment Station.

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Located on the B. & O. R. R., 8 miles N. of Washington, D. C.

NOTICE.

The bulletins of the Station will be mailed free to any citizen of Maryland who sends his name and address to the Station for that purpose.

Correspondents will please notify the Director of changes in their post-office address, or any failure to receive the bulletins.

ADDRESS,

MARYLAND AGRICULTURAL EXPERIMENT STATION,

COLLEGE PARK, MD.

Wheat, Winter Oats, Barley and Lime Experiments.

For the Years 1896 and 1897.

SUMMARY OF RESULTS.

1.—In the variety tests with Wheat for a period of six years, Fultz leads, with an average yield of 37.8 bushels, followed by Currell's Prolific, yielding 36.2, Wisconsin Triumph 34.9 bushels, and Valley 33.7 bushels.

2.—Promising varieties of later introduction are Beal, Rocky Mountain, Ruby and Terry.

3.—With two crops, corn and wheat, the increased yields produced by different amounts of lime, placed the limit of profit with an application of 40 bushels per acre.

4.—Lime in connection with peas, increased the yield of wheat slightly, and produced a marked improvement in the set of grass.

5.—Twenty bushels of stone lime per acre applied for corn in 1893, produced an increase of 110 per cent. in the hay crop of 1896, and a second application of lime (25 bus. Oyster Shell Lime) for corn produced an increase of 66 per cent. of grain in 1897.

6.—The best variety of winter oats tested was Virginia Gray, yielding 48.8 bushels per acre.

7.—The most favorable time for seeding winter oats in this latitude, seemed to be about Sept. 1st.

8.—The hot water treatment of Barley seed was effective in preventing smut; increasing the yield 16 per cent.

Wheat, Winter Oats, Barley and Lime Experiments.

By Robert H. Miller and E. H. Brinkley.

The following experiments were made with wheat, oats and barley during the seasons of 1896 and 1897:

No. 1. Testing varieties of wheat 1896 and 1897.

No. 2. Testing effect of different amounts of lime on wheat 1897.

No. 3. Testing effect of lime and cow peas as a preparation for wheat.

No. 4. Testing the effect of lime on hay and corn.

No. 5. Testing varieties of winter oats 1897.

No. 6. Test as to time of seeding winter oats 1896 and 1897.

No. 7. Testing the effect of hot water treatment for smut on barley 1896.

VARIETY TESTS OF WHEAT—1896.

The land used for this test was in corn in 1894, crimson clover having been seeded at the last working of the corn, which was plowed down the following June as a preparation for the crop of wheat. The ground was gotten in thorough order, and on September 24th fertilizer, at the rate of 300 pounds to the acre, was applied with the drill. This fertilizer was composed as follows:

Dissolved South Carolina rock	667 lbs.
Dried fish	833 "
Muriate of potash	500 "
Total	2000 "

September 27th and 28th, the wheat was seeded, one and one-half bushels to the acre, and 200 pounds additional fertilizer was applied to the acre, composed of:

Dissolved South Carolina rock	1500 lbs.
Nitrate of soda	500 "
Total	2000 "

The plots contained 3622.5 square feet, and every fifth plot was seeded to Currell's Prolific Wheat, as a check plot. The wheat was cut June 15th, and threshed from the field July 2d and 3rd.

TABLE I.

Yields per Acre and Characteristics of Varieties of Wheat Tested in 1896.
Size of Plots 230 feet by 15 3-4 feet, or 3622.5 square feet.

Plot No.	Variety.	Yield per Acre of Grain.	Color of Grain.	Bearded or Smooth.	Nature of Straw.	Time of Ripening.
1	Extra Early Oakley.	31.5	Amber.	Smooth.	Stiff.	Early.
2	Valley	34.8	Red.	Bearded.	Stiff.	Medium.
3	Pool	35.1	Red.	Smooth.	Stiff.	Early.
4	Fultz	36 0	Red.	Smooth.	Stiff.	Early.
5	**Currell's Prolific.**	34.3	Red.	Smooth.	Fairly Stiff.	Early.
6	Badger	33.0	Red.	Smooth.	Stiff.	Early.
7	Ontario Wonder	30.8	Red.	Smooth.	Stiff.	Late.
8	Rocky Mountain	32.9	Red.	Smooth.	Stiff.	Early.
9	Wyandott Red	34.7	Red.	Smooth.	Stiff.	Medium.
10	**Currell's Prolific.**	34.1	Red.	Smooth.	Fairly Stiff	Early.
11	Finley	35.1	Red.	Smooth.	Fairly Stiff	Medium.
12	Wisconsin Triumph.	35.2	Amber.	Smooth.	Stiff.	Early.
13	Garfield	34.9	Red.	Smooth.	Fairly Stiff.	Medium.
14	Terry	37 4	Red.	Smooth.	Stiff.	Early.
15	**Currell's Prolific.**	35.9	Red.	Smooth.	Fairly Stiff	Early.
16	Russel	38.9	Red	Smooth.	Stiff.	Early.
17	Jones' Square Head	29.6	White.	Smooth.	Stiff.	Late.
18	Ruby	36.0	Red.	Bearded.	Stiff.	Late.
19	Deitz	32.3	Red.	Bearded.	Fairly Stiff	Early.
20	**Currell's Prolific**	34.2	Red.	Smooth.	Fairly Stiff.	Early.
21	Lehigh	33 9	Red.	Bearded.	Fairly Stiff.	Medium.
22	Lebanon	32.5	Red.	Bearded.	Weak.	Medium.
23	Tuscan Island	33.8	Red.	Bearded.	Stiff.	Medium.
24	Beal	33.1	Amber.	Bearded.	Stiff.	Medium.
25	**Currell's Prolific.**	27.7	Red.	Smooth.	Fairly Stiff.	Early.
26	Nigger	37.0	Red.	Bearded.	Stiff.	Early.
27	Egyptian	32.1	Red.	Bearded.	Fairly Stiff	Early.

VARIETY TESTS OF WHEAT—1897.

The preparation of land for variety tests of wheat for 1897 was similar to that described in the previous tests, crimson clover having been plowed down. The wheat was seeded September 28th and 29th, one and one-half bushels of seed per acre and 400 pounds of fertilizer applied at the time of seeding. The fertilizer was composed as follows:

Dissolved South Carolina Rock	1000 lbs.
Tankage	500 "
Muriate of potash	300 "
Nitrate of soda	200 "
Total	2000 "

23 varieties were seeded, and the plots were 21 by 200 feet, containing 4200 square feet, or about 1-10 of an acre. Every fifth plot was seeded to Fultz as a check variety. The wheat was cut June 28th and 29th, and threshed from the field. Table II gives yields, etc.

TABLE II.

Yields per Acre and Characteristics of Varieties of Wheat Tested in 1897. Size of Plot 21 by 200 feet, or 4200 square feet.

Plot No.	Variety.	Yield per Acre of Grain.	Color of Grain.	Bearded or Smooth.	Nature of Straw.	Time of Ripening.
1	Extra Early Oakly..	31.5	Amber.	Smooth.	Stiff.	Early.
2	Pool.....	31.2	Red.	Smooth.	Stiff.	Early.
3	Currell's Prolific....	39.9	Red.	Smooth.	Fairly Stiff.	Early.
4	Badger.....	31.5	Red.	Smooth.	Stiff.	Early.
5	**Fultz**.....	46.5	Red.	Smooth.	Stiff.	Early.
6	Ontario Wonder.....	31.1	Red.	Smooth.	Stiff.	Late.
7	Rocky Mountain....	41.8	Red.	Smooth.	Stiff.	Early.
8	Wyandott Red.....	41.0	Red.	Smooth.	Stiff.	Medium.
9	Finley.....	39.0	Red.	Smooth.	Fairly Stiff.	Medium.
10	**Fultz**.....	41 3	Red.	Smooth.	Stiff.	Early.
11	Wisconsin Triumph.	40.6	Amber.	Smooth.	Stiff.	Early.
12	Garfield.....	39.1	Red.	Smooth.	Fairly Stiff.	Medium.
13	Terry.....	37.7	Red.	Smooth.	Stiff.	Early.
14	Russel.....	31.8	Red.	Smooth.	Stiff.	Medium.
15	**Fultz**.....	46.7	Red.	Smooth.	Stiff.	Early.
16	Jones' Square Head.	36.1	White	Smooth.	Stiff.	Late.
17	Valley.....	36.8	Red.	Bearded.	Stiff.	Medium.
18	Ruby.....	39.6	Red.	Bearded.	Stiff.	Late.
19	Deitz.....	39 5	Red.	Bearded.	Fairly Stiff	Early.
20	**Fultz**.....	40.6	Red.	Smooth.	Stiff.	Early.
21	Lehigh	34.7	Red.	Bearded.	Fairly Stiff.	Medium.
22	Lebanon	42.2	Red.	Bearded.	Down.	Medium.
23	Tuscan Island.	38.2	Red.	Bearded.	Stiff.	Medium.
24	Beal.....	49.6	Amber.	Bearded.	Stiff.	Medium.
25	**Fultz**.....	43.9	Red.	Smooth.	Stiff.	Early.
26	Nigger.....	32.7	Red.	Bearded.	Stiff.	Early.
27	Egyptian.....	35.3	Red.	Bearded.	Fairly Stiff.	Early.

In table 3 will be found the yields of varieties of wheat tested at the Station the past season, together with the yields for other years of the varieties in this list, which have been previously tested, and the average yields of those varieties for the years grown.

TABLE III.

Average Yields of Wheat for the Years Grown.

VARIETY.	1897	1896	1895	1894	1893	1891	1890	NUMBER OF YEARS GROWN.	AVERAGE
Garfield	39.1	34.9	24.2	44.2	42.5	10.3	....	6	32.8
Valley	36.8	34.8	39.1	42.9	41.7	...	6.7	6	33.7
Beal	49 6	33.1	31.7	42.3	26.8	....	...	5	36.7
Fultz	43.8	36.0	36.6	41.7	47.1	21.4	....	6	37.8
Currell's Prolific	39.9	33.2	42.3	45.5	36.8	19.7	13.6	7	33.0
Terry	37.7	37.4	....	....	....	....	....	2	37.5
Wisconsin Triumph	40.6	35.2	35.6	35.4	47.9	14.5	....	6	34.9
Finley	39.0	35.1	36.2	40.2	33 6	20.2	12.7	7	31.0
Nigger	32.7	37.0	33.8	39.0	24.0	7.5	6.5	7	25.8
Egypt	35.3	32.1	29.6	39.2	28.0	16.3	15.4	7	30 0
Jones' Square Head	36.1	29.6	27.8	40.0	32.8	....	...	5	33.2
Tuscan Island	38.2	33.8	38.1	38.7	42.4	7.8	16.6	7	30.8
Poole	31.2	35.1	39.1	36.5	....	12.5	9.9	6	27.4
Rocky Mountain	41.8	32.9	38.1	33.3	....	...	...	4	36.5
Wyandott Red	41.0	34.7	38.8	35.7	27.6	19.6	12.7	7	30.0
Badger	31.5	33.0	38.2	37.1	46.1	....	9.3	6	32.5
Dietz	39.5	32.3	37.1	38.9	42.0	10.5	21.2	7	31.6
Extra Early Oakley	31.5	31.5	42.4	38.7	29.6	17.9	....	6	31.9
Lebanon	42.2	32 5	33.4	39.3	30.2	....	....	5	35.5
Ontario Wonder	31.1	30 8	39 7	36.1	31.3	8.5	4.6	7	26.0
Lehigh	34.7	33.9	37.0	35.2	31.4	....	....	5	34.4
Ruby	39.6	36.0	41.0	....	....	....	....	3	38.8
Russell	31.8	38.9	....	....	....	....	....	2	35.3

As will be seen in Table III, the Fultz has given the highest average yield of any of the varieties tested, showing no sign of deterioration, after more than a quarter of a century has passed since its introduction. Its average yield for the six years it has been tested being 37.8 bushels. In exceptional cases, where farmers have gotten poor yields of Fultz, the cause has probably been from having used mixed or deteriorated seed, rather than from any fault of the variety.

Currell's Prolific comes next, with an average yield of 33.0 bushels for the seven years which it has been tested. The average yield of this variety for the six years which the Fultz has been tested is 36.2 bushels. Wisconsin Triumph comes third, with an average of 34.0 bushels for six years. Valley fourth, with an average of 33.7 bushels. Of the promising new varieties may be mentioned Beal, Ruby, Terry and Rocky Mountain.

TESTING THE EFFECT OF DIFFERENT AMOUNTS OF LIME ON WHEAT—1897.

This experiment is a continuation of the one reported in Bulletin No. 46, page 62, of this Station. As stated in this bulletin, "the object of the experiment is to ascertain the most profitable amount of lime to

apply per acre on land, for a series of crops, first corn, followed by wheat, grass, etc.

The land as stated in the report referred to, was very poor, the producing capacity, without the help of lime, being about 17 bushels of corn to the acre.

Eight plots are used in the test, two of them, plots 3 and 6, having had no lime applied; the other six having applications of 10, 20, 30, 40, 50 and 60 bushels to the acre, respectively. These plots were planted to corn the spring of 1896, the yields, etc., of which are reported in Bulletin No. 46. After the corn and fodder had been removed from them the succeeding fall, and the land thoroughly prepared with a "cut-away" harrow, they were seeded to wheat and timothy, one and one-half bushels of wheat, and six quarts of timothy to the acre, and 600 pounds of fertilizer applied, of the same composition as that used on varieties of wheat. The following spring six quarts of early clover seed to the acre was sown. In Table IV will be found the yields of the respective plots.

TABLE IV.

Lime Test with Wheat, 1897.—Size of Plots 160 feet by 30 feet, or 4800 Square Feet.

Plot No.	Quantity Lime Per Acre.	Yield of Grain Per Acre.	Cost of Lime Per Acre. At 18c.* bushel.
	Bush.	Bush.	
1	10	26.0	$1.80
2	20	27.7	3.60
3	No lime.	22.5	.....
4	30	28.7	5.40
5	40	31.9	7.20
6	No lime.	22.7	.....
7	50	31.0	9.00
8	60	32.5	10.80

*This is based on 14 cents bushel for first cost of lime and 4 cents for hauling and spreading

(Stone lime weighing 80 pounds to the bushel).

It will be seen from Table IV that there was a very marked effect from the use of lime on the plots receiving it, and it will be further noticed that the yields of wheat on plots 1, 2, 4 and 5, those receiving 10, 20, 30 and 40 bushels of lime to the acre, respectively, were in direct proportion to the amount of lime applied, but it will be noticed that this relation did not obtain on the plots receiving more than 40 bushels of lime, as plot 7, which received 50 bushels to the acre, yielded less wheat than plot 5, and plot 8, receiving 60 bushels to the acre, yielded only slightly more than plot 5.

The effect of the lime in setting the clover and timothy, is very marked, there being no apparent difference in the stand on any of the plots receiving the lime, while on the check plots 3 and 6, which received no lime, there is a very poor stand of both clover and timothy.

Table V shows the relative profits gained with the crops, corn and wheat, as a result of the application of the different amounts of lime.

TABLE V.

Comparative Profits from Different Amounts of Lime on Corn and Wheat

Plot No.	Bushels of Lime per Acre	Bushels of Corn per Acre 1896.	Bushels of Wheat per Acre 1897.	Value of Gain in Corn 30 cents per bus 1896.	Value of Gain in Wheat at 90 cts per bus 1897.	Value of Gain in Wheat and Corn, 1896 and 1897.	Cost of Lime per Acre at 18 cents per bus.	Relative Profit per Acre for two Crops.
1	10	23.9	26 0	$2 28	$3.06	$5.34	$1.80	$3.54
2	20	25 6	27.7	2.79	4.59	7.38	3.60	3.78
3	No lime.	17 4	22.5	....	..		....	....
4	30	25.8	28.7	2 85	5.49	8 34	5.40	2 94
5	40	27.1	31.9	3 24	8 37	11.61	7.20	4.41
6	No lime.	15.3	22.7		..		....	....
7	50	28 8	31 0	3 75	7.56	11 31	9.00	2.31
8	60	29.8	32.5	4.05	8.91	12 96	10 80	2.16

As will be seen, plot 5, receiving 40 bushels of lime to the acre, gave a slightly larger net return than any of the others, though amounting to but eighty-five cents to the acre more than was received from plot 1, which received only 10 bushels of lime to the acre.

TESTING THE EFFECT OF LIME AND COW PEAS AS A PREPARATION FOR WHEAT.

This experiment was undertaken the spring of 1896. The two plots used in the test immediately adjoined those used in the test of different amounts of lime on wheat. The object of the experiment was to ascertain the effect of lime in the improvement of worn-out soils, when used in conjunction with green manures, such as cow peas. As stated, the land was very poor, its natural capacity being about 17 bushels of corn to the acre. The plots were plowed and prepared for seeding on May 12th, when 40 bushels of stone lime was applied to plot 10, plot 9 receiving none. On the 13th, cow peas, at the rate of five pecks to the acre, were drilled in on each plot without any fertilizer. There was quite an apparent difference in the growth of peas on the two plots, both in the color and density of the growth, being in favor of the plot receiving the lime. On August 24th, the peas on both plots were plowed down. October 2d they were seeded to wheat, one and one-half bushels to the acre, and six quarts of timothy seed sown. 400 pounds of fertilizer of the same composition as that used on varieties of wheat was applied Clover seed was sown on both plots the following spring.

Table VI gives the yields of the two plots. As will be seen, there was a gain of only 1.6 bushels of wheat to the acre from the application of lime, but there is a very marked difference in the set of grass. The plot which received the lime having a very fine stand of both clover and

timothy, while there is scarcely any clover and a poor stand of timothy on the plot receiving no lime.

TABLE VI.

Cow Peas with Lime vs. Cow Peas without Lime, as a Preparation for Wheat.

Plot.		Bushels.
9	Cow Peas no Lime	32.4
10	Cow Peas 40 bushels Lime	34.0
Gain in Favor of Lime		1.6

TESTING THE EFFECT OF LIME ON HAY AND CORN.

This experiment was a continuation of the one undertaken the spring of 1893. The object of the experiment was to note the effect of lime on a series of crops, commencing with corn, followed by wheat and two crops of hay, and this rotation to be repeated again with another application of lime previous to planting in corn. Two plots were used in the test. On one of them stone lime was applied at the rate of 20 bushels to the acre, the other plot receiving none. The lime was applied after being slacked, and just before planting the corn. The increase from the lime in the crop of corn was 5½ bushels to the acre, or a gain of 34.7 percent. In the following crop of wheat, the increase on the limed plot was 8.5 bushels to the acre, or a gain of 37.3 per cent. In the following crop of hay, which was the third crop after liming, the increase from lime was 1271 lbs. to the acre, or a gain of 91.3 per cent.

The second crop of hay was cut the season of 1896, the yields of which are given in Table VII. It should be stated that what little clover and timothy there had been on the unlimed plot when the first crop of hay was cut, had nearly all disappeared, and there was little left but weeds, while on the limed plot there was still a fair stand of timothy and some clover. A comparison of yields of the two plots, therefore, is practically of weeds with hay.

TABLE VII.

Yield of Hay as a Result of Lime vs. no Lime.

Plot.		Yield of Hay Per Acre.
1	Limed	758 lbs.
2	Unlimed	361 "
	Gain from Lime	397 "

As will be seen from Table VII, the plot which was limed yielded more than double the product of that which was not limed, the gain being 110.3 per cent., but at best the yield of hay on the limed plot was poor, and showed a marked falling off from the previous year, when the yield was at the rate of 2662 lbs. to the acre. This falling off in yield was partly due to the season, which was not a favorable one for the hay crop, but more particularly due to the fact that the land was deficient in fertility, having been practically bare of vegetable matter when the experiment was begun, and having produced in the meantime a crop of corn, a crop of wheat and a crop of hay, with one application of fertilizer for the wheat. With the ultimate object of improving the land, it would have been much better to have plowed the one year old sod when the clover was at its best, thereby increasing the amount of humus in the soil, rather than depleting it by cutting the second crop of hay.

CORN.—The winter of 1897 the two plots were plowed, and the following spring 25 bushels of oyster shell lime was applied on the one which had previously been limed, the other plot receiving none, when the plots were planted to corn the second time.

Table VIII gives the yields of corn and fodder. As will be seen, the increase for corn on the limed plot was 17.7 bushels per acre, or a gain of 66.6 per cent. At the last working of the corn crimson clover was sown on both plots, and this will be plowed down as a preparation for wheat, which will be seeded the fall of 1898.

TABLE VIII.

Yield of Corn and Fodder as a result of Lime vs. no Lime.—Size of Plots 11.395 square feet.

Plot.		Per Acre Hard.		Per Acre Soft.		Per Acre Total.		Per Acre Fodder.
		Bus.	Lbs.	Bus.	Lbs.	Bus.	Lbs.	Lbs.
1	Limed	37	0	6	42	43	42	2615
2	Unlimed	16	28	9	56	26	2	1475
	Gain from Lime.....					17	40	1140

Gain for fodder of the limed over the unlimed plot.....39.8 per cent.
Gain for corn of the limed over the unlimed plot.....66.6 per cent.

For the purpose of bringing in closer comparison the yields of the two plots through the series of crops, we give the following table, which contains the yields of the several crops for the years grown, and the per cent. of gain from lime on each crop:

TABLE IX.

Yield of Limed and Unlimed Plots for Five Years.

Crop and Year.	Plot 1, Limed.		Plot 2, Unlimed.		Gain as a Result of Liming.			
	Grain	Hay or Fodder.	Grain	Hay or Fodder	Grain.		Hay or Fodder.	
					Bus.	Per Cent.	Lbs.	Per Cent.
	Bus.	Lbs.	Bus.	Lbs.				
Corn—1893.....	21.4	2200	15.8	1792	5⅓	34.7	408	18.1
Wheat—1894	31.3	.....	22.8	.....	8½	37.3	.....	....
Hay—1895.....	.....	2662	.....	1391	.....	.....	1271	91.3
Hay—1896..... ...	.....	756	.....	360	.....	.....	396	110 3
Corn—1897.....	43.6	2015	26 03	1475	17.6	66.4	540	39.8

As will be seen from Table IX, the effect of lime on each of the five crops thus far harvested has been very marked. Commencing with corn, the gain in grain was 34.7 per cent., and the increase in the yield of fodder was 18.1 per cent. The gain for lime in the following crop of wheat was 37.3 per cent. The third crop in order, hay, showed for lime an increase of 91.3 per cent. In the second crop of hay, or the fourth crop, harvested, the increase was 110.3 per cent. in favor of lime, and the last crop, corn, gave 66.4 per cent. increase of grain and 39.8 per cent. increase of fodder in favor of lime.

VARIETY TESTS OF WINTER OATS—1897.

Three varieties of winter oats were seeded the fall of 1896 on land which had been in strawberries the previous spring. The land had been plowed in July, soon after the strawberries were out of the way, and laid fallow until September 3rd, when the oats were seeded, two bushels to the acre, and 300 pounds of fertilizer applied.

In Table X will be found the yields of the varieties tested:

TABLE X.

Yield of Varieties of Winter Oats, 1897.—Size of Plots 287 ft. by 45 ft. or 9315 square feet.

Plot No.	Name.	Bushels per Acre.
4	Hatchett Black Winter.....	37.4
5	Winter.....	47.6
6	Virginia Gray.....	48.8

TEST AS TO TIME OF SEEDING WINTER OATS—1896 and 1897.

Bulletin No. 35 reports a test of winter oats seeded the fall of 1894. This was sown September 24th, or about the time of seeding wheat. It made a comparatively light growth in the fall, and much of it was thrown out the succeeding winter. It was harvested June 28th, and the yield was only 31.6 bushels to the acre. With the object of ascertaining if earlier seeding would not give better results, three seedings were made the fall of 1895 and also 1896. The dates of these seedings were September 1st, 15th and 30th. Two bushels of seed to the acre, of the variety known as the "Virginia Gray," was sown, and a light application of about 250 pounds of fertilizer applied. The size of plots in 1896 was 15 3-4 by 264 feet, in 1897 21 feet by 60 feet.

In Table XI will be found the yields of the different dates of seeding for the two years in which the tests were made. As will be seen the early seeding gave a decidedly better yield for both years which the test was made.,

TABLE XI.

Yield per Acre of Winter Oats Seeded at different Periods 1896 and 1897.

Plot No.	Variety Used.	Time of Seeding.	Bush. 1896	Bush. 1897	Average Bush.
1	Virginia Gray.....	September 1st.	63.7	60.4	62.0
2	Virginia Gray.....	September 15th.	38.2	53.0	45 6
3	Virginia Gray.....	September 30th.	54.1	51.0	52.5

TEST OF HOT WATER TREATMENT OF SEED BARLEY FOR PREVENTION OF SMUT.

The Indiana Experiment Station recommends the following treatment for small grains, such as wheat, oats or barley, for the prevention of smut:

"Immerse the seed grain for five minutes in water standing at first at 135 to 145 F., which may drop during the operation to 130, or may even fall below 130, if the time is correspondingly prolonged.

"After drying, by spreading upon a floor, the seed may be sown immediately or after a time, with equally beneficial results in either case."

As the two crops of barley grown here had been badly affected with smut, it was deemed advisable to test the effect of this treatment for its prevention. Two plots of barley were seeded the fall of 1895; on one of them the seed was treated as above, the other was not treated. The effect of the treatment was very marked, the plot on which the seed had been treated having practically no smut, while on that which was untreated there were from 15 to 20 per cent. of the heads smutted.

Table XII gives the yields of the treated and untreated plots:

TABLE XII.

Results of the effect of Hot Water Treatment for Smut on Barley, 1896.
Size of Plot 264 feet by 15 3-4 feet, or 4158 square feet.

Plot No.		Yield per Acre.
		Bus.
1	Not Treated	34.4
2	Treated	40.0
Gain as a result of treatment		5.6

As will be seen from Table XII. the plot on which the seed was treated yielded 5.6 bushels more to the acre than the plot which had untreated seed, or a gain of 16 per cent.

PUBLICATIONS OF THE MARYLAND EXPERIMENT STATION.

	Bulletin	No. 1,	June,	1888, History, Organization and Work of the Station.
*	"	" 2,	Sept.,	1888, Cutting Seed Potatoes for Planting. Appendix, with Information About Station.
*	"	" 3,	Dec.,	1888, Fodder-Corn and Fodder-Cane. Appendix, About Taking and Sending Samples.
*	"	" 4,	March,	1889, Experiment Orchard.
	"	" 5,	June,	1889, Horticultural Department and Field Experiments.
	"	" 6,	Sept.,	1889, Commercial Fertilizers.
	"	" 7,	Dec.,	1889, Farm Manures.
*	"	" 8,	March,	1890, Some Feeding Trials.
*	"	" 9,	June,	1890, Strawberries.
*	"	" 10,	Sept.,	1890, Wheat.
*	"	" 11,	Dec ,	1890, Tomatoes.
	"	" 12,	March,	1891, Pig Feeding.
*	"	" 13,	June,	1891, Strawberries.
*	"	" 14,	Sept ,	1891, Wheat
*	"	" 15,	Dec.,	1891, Experiment Vineyard.
*	"	" 16,	March,	1892, Wheat Insects.
*	"	" 17,	June,	1892, Strawberries and Seed Potatoes.
*	"	" 18,	Oct.,	1892, Sweet Potatoes.
*	"	" 19,	Dec.,	1892, Tomatoes.
*	"	" 20,	March,	1893, The Composition and Digestibility of the Different Parts of Corn Fodder.
*	"	" 21,	June,	1893, The soils of Maryland.
	"	" 22,	Sept.,	1893, Steer Feeding: a Well Balanced vs. a Poorly Balanced Ration
*	"	" 23,	Dec.,	1893, Injurious Insects of Maryland.
	"	" 24,	Feb.,	1894, Composition of Commercial Fertilizers Sold in This State.
*	"	" 25,	March,	1894, Agricultural and Horticultural Departments. Corn, Potatoes, Tomatoes, Strawberries, Grapes, &c.
	"	" 26,	June,	1894, Tobacco.
	"	" 27,	Aug.,	1894, Composition of Commercial Fertilizers Sold in This State.
	"	" 28,	Sept.,	1894, Experiments with Wheat and Barley.
	"	" 29,	Dec.,	1894, Further Investigations on the Soils of Maryland.
*	"	" 30,	Jan.,	1895, Composition of Commercial Fertilizers Sold in This State.
	"	" 31,	March,	1895, Potato Experiments.
	"	" 32,	April,	1895, The San Jose Scale.
	"	" 33,	April,	1895, Horticultural and Agricultural Departments. Small Fruits, Vegetables and Field Corn.
	"	" 34,	July,	1895, Composition of Commercial Fertilizers Sold in This State.
	"	" 35,	Sept.,	1895, Wheat, Barley, Oats and Hay Experiments.
	"	" 36,	Dec.,	1895, Steer Feeding: a Well Balanced vs. a Poorly Balanced Ration.
	"	" 37,	Feb.,	1896, Composition of Commercial Fertilizers Sold in This State.
	"	" 38,	March,	1896, Potato Experiments.
	"	" 39,	April,	1896, Spray Calendar.
	"	" 40,	Aug.,	1896, Composition of Commercial Fertilizers Sold in This State.
	"	" 41,	Sept.,	1896, Test of Methods of Preparing and Feeding Corn Fodder.
	"	" 42,	Oct.,	1896, The Md. Trees and Nursery Stock Law and Other Information of Special Interest to Nurserymen and Fruit Growers.

Bulletin No. 43, Dec., 1896, Report upon the Value of a New Corn Product.
* " " 44, Dec. 1896, The Soils of the Hagerstown Valley.
* " " 45, Feb. 1897, Commercial Fertilizers Sold in This State.
" " 46, March, 1897, Corn and Potato Experiments
" " 47, June, 1897, Dairy Farming.
" " 48, June, 1897, Some Common Injurious Plant Lice with Suggestions for their destruction.
" " 49, Aug., 1897, Composition of Commercial Fertilizers Sold in This State.
" " 50, Sept., 1897, Rust and Leopard Spot, two Dangerous Diseases of Asparagus.
" " 51, Dec , 1897, Horse Feeding. Tests of the Digestibility of Oats, Corn, Hay and the New Corn Product.
" " 52, Feb. 1898, Composition of Commercial Fertilizers Sold in This State.
" " 53, March, 1898, Special Investigation of the So-called "New" Horse Disease in Maryland.
" " 54, March, 1898, Tomatoes.
" " 55, May, 1898, The Black Peach Aphis—Cut Worms in Young Tobacco—Law Providing for the Suppression and Control of Insect Pests and Plant Diseases in Maryland.

*Special Bulletin (A), Fair Edition, 1889, Facts About the Station.
* " " (B), July, 1890, Potash and Paying Crops.
" " (C), Oct., 1890, Composition of Commercial Fertilizers Sold in This State.
* " " (D), Feb., 1891, Composition of Commercial Fertilizers Sold in This State.
* " " (E), Aug., 1891, Composition of Commercial Fertilizers Sold in This State.
* " " (F), Jan., 1892, The Agricultural Outlook for Maryland.
" " (G), Feb., 1892, Composition of Commercial Fertilizers Sold in This State.
" " (H), July, 1892, Government Direction of Agriculture in Europe.
* " " (I), Aug., 1892, Composition of Commercial Fertilizers Sold in This State.
* " " (J), Feb., 1893, Composition of Commercial Fertilizers Sold in This State.
* " " (K), June, 1893, Composition of Commercial Fertilizers Sold in This State.

First Annual Report of the Maryland Agricultural Experiment Station, 1888.
Second " " " " " " " " 1889.
Third " " " " " " " " 1890.
*Fourth " " " " " " " " 1891.
Fifth " " " " " " " " 1892.
Sixth " " " " " " " " 1893.
Seventh " " " " " " " " 1894.
Eighth " " " " " " " " 1895.
Ninth " " " " " " " " 1896.
Tenth " " " " " " " " 1897.

*Edition Exhausted—no more for distribution.

MARYLAND

Agricultural Experiment Station.

Eleventh Annual Report.

COLLEGE PARK, MD.

1897-98.

THE
Maryland Agricultural Experiment Station.

CORPORATION.

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The Station is located on the B. & O. R. R. 8 miles north of Washington, D. C.

Visitors will be welcomed at all times, and will be given every opportunity to inspect the work of the Station in all its departments.

The Bulletins and reports of the Station will be mailed regularly, free of charge, to all residents of the State who request it.

ADDRESS:

AGRICULTURAL EXPERIMENT STATION,

College Park, Maryland.

To His Excellency, Lloyd Lowndes,

Governor, and President of the Board of Trustees,

Annapolis, Maryland.

Sir:—

In accordance with the provisions of Section No. 3, of Act of Congress, approved March 2, 1887, "To Establish Agricultural Experiment Station, etc.," I have the honor to transmit the Eleventh Annual Report of the Maryland Agricultural Experiment Station for the fiscal year ending June 30, 1898. This report covers the last year of the administration of my predecessor, Director Robert H. Miller, who resigned in June, 1898.

Very respectfully yours,

H. J. PATTERSON,

Director of the Experiment Station.

Transmitted January 21, 1899.

ELEVENTH ANNUAL REPORT

—OF THE—

Maryland Agricultural Experiment Station

For the Fiscal Year July 1st, 1897 to June 30th, 1898.

Agricultural Department.—The work of the Agricultural Department during the past year has been in the main a continuation of the work outlined in previous reports and bulletins. It is necessary in most all work of this class to repeat the tests several times, so as to get averages covering a number of years, with the variations of weather, etc., which accompany them, so that the conclusions which are drawn may be as broad and as free from error as possible. Some of the culture tests have now been running for five and six years, giving very uniform results, so that they may be considered fairly conclusive on the questions involved. Such tests may now be treated as completed, and with another year be replaced by other investigations.

Wheat Experiments.—The experiments conducted with wheat consisted wholly of variety tests. The wheat went through the winter well, and gave promise, up to within three weeks of harvest, of as good yields as ever procured here, but the excessive hot and dry weather following a period of excessive rainfall caused the wheat to ripen prematurely, which cut down the yields from 25 to 50 per cent. of what were expected.

Potato Experiments.—The same line of investigations has been continued with the potato crop as mentioned in previous reports. These tests, owing to the very dry and unfavorable weather at the critical time of growth, have resulted in almost total failure.

Corn Experiments.—The work with corn has been culture tests, and the results agree very well with those reported in our bulletins.

Lime Experiments.—The lime tests which have been inaugurated formed a very important part of the work of this department, not only because of the marked results obtained, but also of the important office which it performs in the economical renovation of worn soils in many of the formations of this State. The detailed results of these tests, as far as completed to date, are given in Bulletin No. 56.

Tobacco Experiments.—The work has been continued and extended on tobacco, and now consists of fertilizer tests, culture tests, curing tests and tests of varieties. The work of testing the possibility of the culture of some of the cigar types of tobacco on our soil with pecu-

liar methods of fertilization and culture give promise of very valuable results. Filler of good flavor and particular fine burning qualities has been produced.

Forage Crops.—A test of some of the more important forage crops was started early the present spring, but the failure of the seed to germinate, so as to give a fair stand, caused the experiment to be abandoned and the plots harrowed up and prepared for fall grains.

Dairy Department.—The work of this department is being continued in about the same direction as outlined when the work was first taken up. Experiments of this class are quite expensive, and it takes considerable time to arrive at satisfactory conclusions, but is justified by the interest shown in this department of our work by visitors and correspondents.

Chemical Department.—In addition to the regular routine of laboratory work and other miscellaneous matters referred to that department, there was very considerable time given to the chemical work in connection with the digestion and feeding experiments with horses, the results of which were published in Bulletin No. 51. There was also considerable work done in connection with other feeding tests, the dairy, and the study of laboratory methods for the Association of Official Agricultural Chemists.

Horticultural Department.—The variety and fertilizer tests with the leading vegetables and fruits of this State, and upon which reports have been made from time to time, have been continued much after the manner previously outlined. New work has been taken up in co-operation with the United States Department of Agriculture and other Experiment Stations in a study of the relative growth of some varieties of widely disseminated forest trees. Co-operative work is also in progress with different varieties of foreign apples and peaches, with a view of making a study of their adaptation to our soil and value for our market requirements.

The work on spraying tomatoes to prevent blight has given some marked results, which will be of great value to growers and the canning industry of this State. A detailed report of these tests is given in Bulletin No. 54.

Entomological Department.—The work of this department has been well cared for and vigorously pushed during the year. The duties of this department, in connection with the State work, necessitated under the "Trees and Nursery Stock Law," has given exceptional opportunity for becoming acquainted and coming into direct contact with the entomological conditions in the State.

Much time has been devoted to the San Jose scale, with the view of finding some remedy which would be practical for combatting the pest. In this connection has been conducted the largest series of experiments with hydrocyanic acid gas upon deciduous fruit trees, both in the nursery and in bearing orchards, that has ever been conducted east of the Rocky Mountains. These experiments have proved the manner

of treatment to be practical and effective. The detailed results will be given in a bulletin soon to be issued. Tests of the use of hydrocyanic acid gas for exterminating plant lice on trees have given favorable results. Physiological tests of the gas have also been made.

These tests have been contributed to very materially both in facilities and time by R. S. Emory, Esq., of Chestertown. Considerable work has been conducted with methods for controlling strawberry weevil, *Anthanomous signatus*, and the rose chafer, or rose bug, *Microdactylus subspinosus*.

Much attention has been given to the natural enemies, both parasitic insects and fungous diseases, of insects in this State. Bulletin No. 55 of this department gives a brief illustrated account of the black peach aphis, *Aphis prunicola*, which appeared in many nurseries and orchards in destructive numbers this spring. Bulletin 55 also gives methods for the destruction of the cut worms usually found on tobacco.

With the passage of the State Horticultural law by the last Legislature and the appropriation carried therewith, the work of the entomological department will be enabled to greatly extend its sphere of usefulness.

Department of Soil Physics.—The work in the department of soil physics has been carried on during the past year in much the same manner as it has in former years. The greater part of the year has been devoted to the work of classification and the examination of the physical properties of the soils of the State.

The preliminary classification of the various soil formations had been completed some time ago, as far as the distribution of the geological formation was known. During the past year, however, the State Geological Survey has had a large force of men in the field in different sections of the State, so that considerable information has been added to our geological knowledge of the State. In co-operation with the Geological Survey, a large amount of field work has been done in the extreme western portion of the State, several weeks having been devoted to the study of the soils of Garrett and Alleghany counties. A large amount of information concerning the soils of the two counties was obtained and several hundred soil samples were collected. Already considerable of the material collected has been examined, and, as soon as the examination is completed, a bulletin will be published, setting forth the results of the investigations in the two counties.

In co-operation with the Maryland State Weather Service, a series of investigations was commenced at the beginning of the present growing season upon the moisture and temperature conditions of some of the different soil types of the State. The method used in taking the moisture and temperature observations is the one so successfully employed by the Division of Soils in the Department of Agriculture. These observations are taken by reading the resistance which is offered to a current of electricity forced through the soil. Six of these moisture instruments were placed in the hands of competent observers in different sections of the State, representing different soil formations. The localities repre-

sent some of our truck lands of Southern Maryland, wheat lands of the Eastern Shore, our best farm lands of Northern and Central Maryland and the fine wheat and grass lands of Western Maryland. It is expected that such a series of observations will throw much light on some of our most difficult soil problems in relation to the distribution of the various crops upon them.

Likewise, by co-operating with the State Weather Service, a series of meteorological stations was established to study the influence of Chesapeake Bay on the trucking interests and the effect of elevation upon the mountain peach industry in the Hagerstown Valley. A large number of these stations were established, all being equipped with registering instruments and suitable instrument shelters. Along Chesapeake Bay two lines of stations were established on either side of the bay, extending from the shore inward one and a-half miles. In Hagerstown Valley two sets of stations were established on the eastern side of the valley and one on the western side. These stations were placed at different elevations, with reference to the most successful locations for peach orchards. All of those stations have been in operation since early in the spring.

During the coming year it is expected that the work which has been taken up during the past year will be considerably extended. In co-operation with the State Geological Survey, a large amount of time will be devoted to field work, so that as a result of this work accurate and complete soil maps can be made for the areas visited.

The work of investigating the moisture and temperature conditions of our typical soils, in their relation to the distribution of crops, will be likewise extended as much as possible.

A series of investigations is to be taken up in connection with the various fertilizer tests now being carried on at the Station. The object of these investigations is to determine, if possible, the effect the various fertilizers have on modifying the physical conditions of the soil.

Veterinary Department.—The connection of this department with the Station work has been in the main but a nominal one, and has had to do mainly with questions of correspondence and advice.

The small amount of money which the Station could devote to this department, coupled with the very expensive character of veterinary investigations, has made it impossible to undertake much in this way. The new horse disease which has made its appearance in the State at several times and places was looked into as much as possible, and the results of the observations are recorded in Bulletin No. 53.

Farmers' Meetings and Exhibitions.—The policy has been continued of the Station officers participating as often as possible in Farmers' Institutes and other appropriate farmers' meetings held in different parts of the State. This class of work not only affords a good opportunity to acquaint the people with the work of this Institution, but also is the means of acquiring much information which is very useful in planning and prosecuting various lines of investigation. In past years

considerable has been done in the way of attending and making exhibits at agricultural fairs and other exhibitions. These exhibits give the people object lessons of the results of experiments, and will call it to the attention and impress it upon many people that could not be reached by the press or bulletin. It is hoped that funds of the Station will permit the resumption of some work in this direction, as it would be very beneficial to all interests.

Visitors and Correspondence.—These two methods of intercourse with those who are interested in the work of the Station are encouraged as much as possible, and both are increasing yearly. No opportunity is lost to make it known that visitors, singly or in parties, with or without previous notice, are always welcome, and that every effort will be made to make such visits pleasant and instructive. Those who cannot come are encouraged to write, suggesting and inquiring, and the Station officers give such letters every possible attention. This correspondence now constitutes a large part of the office work and embraces a great variety of subjects connected with agriculture and horticulture.

Publications.—The following are the publications of the Station for the past year:

Bulletin No. 49, August, 1897, Composition of Commercial Fertilizers Sold in the State, pp. 104 to 160.

Bulletin No. 50, September, 1897, Rust and Leopard Spot, Two Dangerous Diseases of Asparagus, pp. 161 to 168.

Bulletin No. 51, December, 1897, Horse Feeding. Tests of Digestibility of Oats, Corn, Hay and the New Corn Product, pp. 10 to 46.

Bulletin No. 52, February, 1898, Composition of Commercial Fertilizers Sold in This State, pp. 47 to 106.

Bulletin No. 53, March, 1898, Special Investigations of the So-Called "New Horse Disease" in Maryland, pp. 107 to 114.

Bulletin No. 54, March, 1898, Tomatoes, pp. 115 to 134.

Bulletin No. 55, May, 1898, The Black Peach Aphis. Cut Worms in Young Tobacco. Law Providing for the Suppression and Control of Insect Pests and Plant Diseases in Maryland, pp. 135 to 150.

Bulletin No. 56, June, 1898, Wheat, Winter Oats, Barley and Lime Experiments, pp. 151 to 166.

The Station Staff.—The only change in the scientific staff of the staff during the year has been the addition, commencing in May, of E. Dwight Sanderson, B. S., as assistant entomologist, which was necessitated by the extension of the work under the new law for the suppression of insect pests.

The acknowledgments of all the workers of the Station are due to the Board of Trustees, and especially to its Agricultural Committee, for continued confidence and support, and to the public for patient interest and friendly encouragement.

Weather Report and Financial Statement.—Appended herewith is given the Meteorological Summary for 1897, and the financial report of the Treasurer for the fiscal year ending June 30, 1898:

Meteorological Summary

FOR 1897.

Temperature in Degrees—Fahrenheit.

Month.	Precipitation.	Temperature—Mean.				Extreme Maximum.	Extreme Minimum.
		Dailey Mean.	Maximum.	Minimum.	Daily Range.	Record and Date.	Record and Date.
	Inches						
January.....	1.76	27.5	35.5	19.5	16 0	54-10th.	=2-30th.
February...	6.11	34.2	41 8	26.5	15 3	60-19th.	10-1st.
March.....	2.81	43.9	53.9	33 9	20.0	78-22nd.	23-11th.
April.....	3.35	51.8	64.5	39.2	25.3	86-25th.	26-21st.
May.....	7.45	60.1	70.4	49 8	20 6	89 10th.	39-27th.
June.....	3.49	68 0	70.0	57.0	22 5	91 30th.	38 2nd.
July.....	5.29	77.0	83 0	64.0	19.5	90 2nd.	54-15th.
August....	3.02	68 0	82 0	60 0	18 8	90-14th.	51-8th.
September..	1.78	67 3	80.6	53.6	26 5	97-10th.	36-29th.
October....	4.00	55.9	65.2	46.3	18.8	88 16th.	31-31st.
November..	3 98	43.7	53.4	33.2	19.4	68 21-4th.	21-22 29th.
December..	3.30	39.3	47 9	31.2	19.0	68-18th.	13-25th.
Yearly.....	46 34	53.05	62.3	42.3	20.14	97-Septem'r	=2 January.

FINANCIAL REPORT, 1897-1898.

Joseph R. Owens, Treasurer, in account with the Maryland Agricultural Experiment Station.

1897.	SOURCE OF REVENUE.	DR.
July 1,	To unexpended balance	$ 430.56
" "	U. S. Appropriation	15,000.00
" "	sale of produce	394.61
" "	" dairy products	1,032.95
		$16,858.12

NATURE OF EXPENDITURES.

1898.		CR.
June 30,	By salaries	$8,188.84
" "	labor	3,114.90
" "	publications	610.02
" "	postage and stationery	120.83
" "	freight and express	154.29
" "	heat, light and water	242.09
" "	chemical supplies	85.52
" "	seeds, plant and sundry supplies	410.02
" "	fertilizers	168.99
" "	feeding stuffs	728.52
" "	library	119.91
" "	tools, implements and machinery	596.96
" "	furniture and fixtures	179.80
" "	scientific apparatus	16.12
" "	live stock	340.50
" "	travelling expenses	121.93
" "	contingent expenses	77.00
" "	buildings and repairs	1,058.99
" "	unexpended balance	522.89
		$16,858.12

We, the undersigned, duly appointed auditors for the corporation, have examined the books and accounts of the Maryland Agricultural Experiment Station for the year ended June 30, 1898, that we have found the same well kept and classified as above; that the receipts for the year are shown to have been $16,858.12, and the corresponding disbursements to have been $16,335.23. Vouchers for the disbursement of this sum are on file and have been examined by us, and are found correct, thus leaving an unexpended balance of $522.89, which sum is to be accounted for by the Treasurer of the Experiment Station in the year beginning July 1st, 1898.

(Signed)

MURRAY VANDIVER, } *Auditing Committee*
C. H. STANLEY, } *Board of Trustees.*